



Town of Narragansett, RI

Strategy for Reducing Risks From
Natural Hazards in Narragansett, Rhode Island:
A Multi-Hazard Mitigation Strategy

December 2011



Strategy for Reducing Risks From Natural Hazards in Narragansett, Rhode Island: A Multi-Hazard Mitigation Strategy



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1.0 INTRODUCTION

The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 and to achieve eligibility for the Federal Emergency Management Agency (FEMA) hazard mitigation grant programs. The 2011 Plan is an update of the Town of Narragansett's 1999 Hazard Mitigation Plan.

The Local Hazard Mitigation Committee (LHMC) conducted a risk assessment to update the hazards identified and profiled in the previously approved plan. The updated hazards profiled in the 2011 plan are the following:

- Severe Storms
- Hurricanes
- Flooding and Dam Failure
- Earthquake
- Tornadoes
- Heat Wave
- Drought

The plan also assesses the vulnerability of people, structures, and critical facilities to these hazards and examines the capabilities in place to mitigate them. Based upon the risk assessment, the LHMC updated the mitigation strategy. The LHMC revised the goals and mitigation actions for reducing risk from hazards. The LHMC also went further in-depth into the various hazards that affect the Town and incorporated historical data into those hazards.

In the 2011 update planning process, the Narragansett LHMC reviewed and updated each of the sections of the previously approved plan, including improving organization and formatting and adding substantially more in-depth information specific to the Town of Narragansett. The LHMC also decided to profile tornadoes, heat wave, and drought and added those to the list of hazards that could affect Narragansett. The LHMC also expanded the goals from the 1999 Hazard Mitigation Plan and added specific objectives to each goal. The LHMC decided not to add manmade hazards, however, discussed the importance of awareness. The LHMC recognized that many of the manmade hazards are addressed in the Town of Narragansett's Emergency Operations Plan as Appendices. The LHMC also decided not to profile wildfires/conflagration due to its low probability and impact. The Town also has no history of wildfires.

The LHMC deleted several vulnerable areas noted in the 1999 Hazard Mitigation Plan. Other new vulnerabilities were added. The plan has been afforded a public hearing by the LHMC and a public hearing by the Town Council.

Note to Reviewers: A signed resolution will be included in this section once the plan has been reviewed and received preliminary approval pending adoption by FEMA.

1.1 WHAT IS HAZARD MITIGATION?

Hazard mitigation is an action taken to permanently reduce or eliminate long-term risk to people and their property from the effect of natural, technological, or man-made hazards.

Money spent today on preventative measures can significantly reduce the cost of tomorrow's post-disaster recovery. By planning ahead, Narragansett minimizes the economic and social disruption that results from natural hazards including floods, severe weather, hurricanes and earthquakes which can result in the destruction of property, loss or interruption of jobs, loss of business and loss of life.

1.2 WHAT HAZARD MITIGATION CAN DO FOR NARRAGANSETT

The purpose of this plan is to recommend actions and policies for the Town of Narragansett to minimize the social and economic loss of hardships resulting from natural hazards. These hardships include the loss of life, destruction of property, damage to crucial infrastructure and critical facilities, loss/interruption of jobs, loss/damage to businesses, and loss/damage to significant historical structures. Hazardous events include severe weather, hurricanes, floods, earthquakes, tornadoes, heat wave, and drought. To minimize the social and economic hardships, the Town of Narragansett implements the following general actions and policies:

- Revisions to the Town's comprehensive plan
- Incorporation of hazard mitigation into the site plan review process
- State and Local Building Code Review
- Public education/outreach
- Post-disaster recovery opportunities/strategies
- Corrective/maintenance measures for town infrastructure and facilities

The adoption and implementation of this hazard mitigation plan will assist Narragansett in receiving assistance from the Federal Emergency Management Agency (FEMA) for pre- and post- disaster assistance such as:

- National Flood Insurance Program
- FEMA's Community Rating System
- FEMA's Pre-Disaster Flood Mitigation Assistance Program
- FEMA's Post-Disaster Hazard Mitigation Grant Program

Narragansett participates in the National Flood Insurance Program (NFIP). The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the

Federal Government. This insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and replacing their contents. Narragansett participates in the Community Rating System (CRS) Program. The CRS provides discounts on National Flood Insurance Program (NFIP) premiums in those communities that establish floodplain management programs that go beyond NFIP minimum requirements. Under the CRS, communities receive credit for more restrictive regulations, acquisition, relocation, or flood proofing of flood-prone buildings, preservation of open space, and other measures that reduce flood damages or protect the natural resources and functions of floodplains. Narragansett currently has a rating of eight (8) which qualifies all homeowners with flood insurance to receive a ten percent (10%) discount on their premium.

FEMA's Pre-Disaster Flood Mitigation Assistance Program makes grants available for communities to implement flood mitigation planning and activities such as acquisition, relocation, and retrofitting of structures. This program is only available for communities having a pre-existing approved hazard mitigation plan.

FEMA's Post-Disaster Hazard Mitigation Grant Program is only available for communities after a federally declared disaster. An approved mitigation plan expedites the application process for pre- and post- federal mitigation funding, as well as, assists in ensuring a funded project is eligible and technically feasible.

1.3 NARRAGANSETT'S GOALS AND OBJECTIVES

Narragansett adopts this mitigation strategy for the purpose of enhancing quality of life, protecting property, and preserving resources for residents and visitors. This will be accomplished by:

1. Implementing hazard mitigation actions in order to protect Narragansett's cultural, historical, structural, economic, and natural environment.
 - Protect Narragansett's critical infrastructure.
 - Continue to manage the development in hazard-prone areas to reduce economic loss.
 - Continue to reduce flood losses through compliance with NFIP requirements.
2. Promoting educational opportunities to introduce residents and visitors to the risks of natural hazards and the various appropriate mitigation strategies that can be taken.
 - Continue and expand outreach efforts through the use of various communication methods.
 - Continue to work with residents on mitigation strategies.

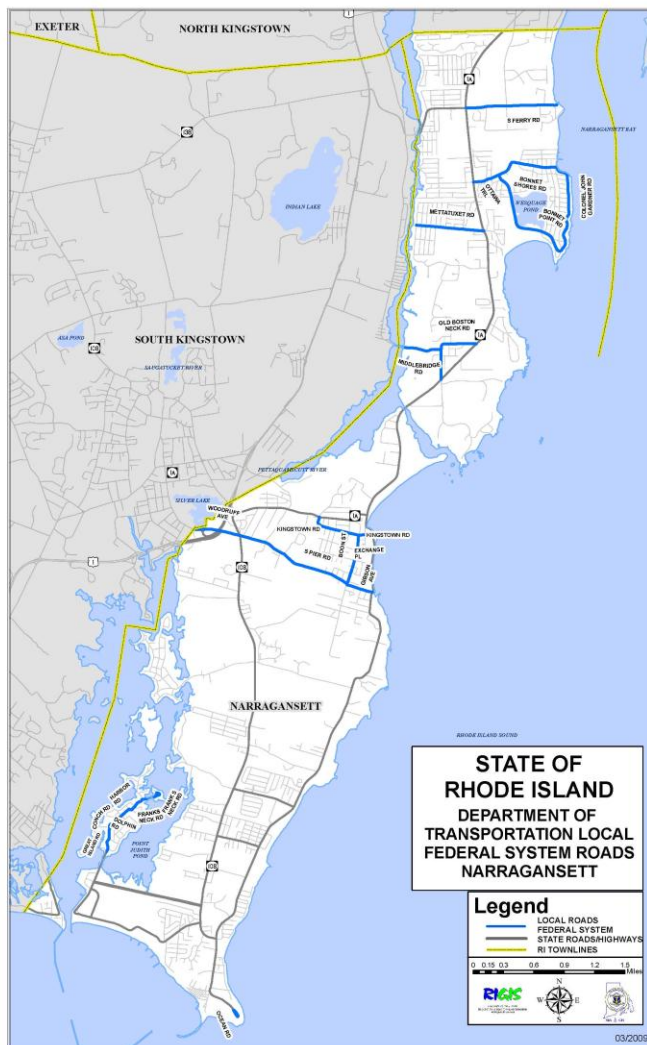
This municipal strategy, as approved by the Rhode Island State Hazard Mitigation Committee (RI SHMC), is consistent with state objectives for natural hazard mitigation. The role of the RI SHMC is to review, grade and prioritize all hazard mitigation activities and grants that come through the Rhode Island Emergency Management Agency (RIEMA). This committee is also responsible for reviewing and approving revisions and updates to the state hazard mitigation plan (§409 Plan). The information that is compiled in this municipal strategy will be incorporated into the state hazard mitigation plan.

1.4 A LOOK AT NARRAGANSETT

Narragansett is exposed on three sides by water, with Narragansett Bay to the east, Rhode Island Sound to the southeast, and Point Judith Pond and Narrow River to the west. The coastal environment defines the character of the town, and is a major attraction for tourists and residents alike; however, it also makes Narragansett vulnerable to natural hazards. The town's 49 miles of coastline vary from steep, rocky shores to low, sandy beaches. The town is a growing suburban community with many coastal areas, which decades ago were home to summer cottages, and now support dense residential and commercial uses. The Hurricane of 1938 was the last Category 3 hurricane to hit Rhode Island. The Blizzard of 1978 dropped over two feet of snow on the region and the rain event of March 2010 delivered the first 100 year storm in several years. Therefore, much of the Town's at-risk population has never experienced a major storm event. Narragansett experiences a few nor'easters each winter. The town has never had any serious problems in dealing with wildfires, ice or earthquakes.

1.4.1. POPULATION

Since 1950, Narragansett has experienced a rapid and sustained increase in population. While the amount and rate of growth appear to have slowed somewhat in recent years, population has grown from 2,288 people in 1950 to 15,868 people in the year 2010 according to the United States Bureau of the Census. This rate of growth is much faster than that experienced in Washington County or the State of Rhode Island as a whole. As of the census of 2010, there were 15,868 people, 6,704 households, and 3,560 families residing in the town. The population density was 1,125.4 people per square mile (428.9/km²). There were 9,470 housing units at an average density of 671.6 per square mile (255.9/km²). The racial makeup of the town was 96.9% White, 1.5% African American, 1.3% Native American, 1.2% Asian, 0.01% Pacific Islander, and 0.6% from other races. Hispanic or Latino of any race was 1.7% of the population.



1.4.2. ECONOMY

According to the 2000 U.S. Census the median income for a household in the town was \$50,363, and the median income for a family was \$67,571. Males had a median income of \$45,436 versus \$31,759 for females. The per capita income for the town was \$28,194. About 4.9% of families and 16.0% of the population were below the poverty line, including 8.4% of those under age 18 and 5.0% of those ages 65 or over.

Narragansett has certain characteristics which are considered advantages in promoting economic development, as follows:

- Good quality of life – wide range of housing stock, community facilities and services;
- Favorable tax rate;
- Proximity to the State University, a major hospital, and several beaches;
- Port of Galilee;
- 75 percent of Town is sewered in terms of population served, and approximately 50% in terms of land area;
- Available and diverse workforce.

Commuting

Narragansett is approximately a 30 minute drive from T.F. Green Airport, 24 miles from Providence, and approximately 93 miles to Boston, Massachusetts.

Poverty Rates

According to the 2000 U.S. Census American Community Survey About 4.9% of families and 16.0% of the population were below the poverty line, including 8.4% of those under age 18 and 5.0% of those ages 65 or over.

1.4.3. LAND USE

The Narragansett Comprehensive Plan provides the primary policy for land use decision-making for Town agencies.

Narragansett's physical and topographic characteristics define the Town. Located on three end to- end peninsulas with islands and barrier beaches, each part of town shares its identity with a water body, the coastline, and a location on the linear spine of the Towns road system. These land areas have attracted people to live and prosper from the beauty and utility of the local setting. Seasonal and permanent villages of Native American tribes (the Narragansett Tribe) were located in this area. Early settlement by European immigrants was based on subsistence agricultural uses and simple maritime and commerce activities. Over time, these uses grew to take advantage of local opportunities and to meet the needs of the population. With the advent of rail service (after 1850) and the automobile (after 1900), Narragansett became more accessible to other areas and this attracted people to for tourism and summer residences. After

World War II, increasing suburbanization and improving accessibility brought even more growth to Narragansett for seasonal and year-round residence.

Land in Narragansett is being used for a variety of purposes at the present time - ranging from farms and forest to residential development and business development. Overall, about 79 percent of all land in Narragansett has been developed for residential, business, or industrial purposes, or committed to a specific use such as open space or municipal use. About 1,856 acres (about 21 percent of the land area of Narragansett) is potentially available for future development.

Narragansett's future land use plan is based on:

- *Conservation of critically important lands*
- *Preservation of open space including greenbelts in specific environmentally sensitive and scenic areas*
- *Maintenance and enhancement of community character*
- *Managing residential development*
- *Compatible economic development in appropriate areas, including increasing opportunities for quality tourism development*

In consulting the Future Land Use Plan, the following observations are important:

1. *The Future Land Use Map is a depiction of acceptable, anticipated, and desired land use patterns for a ten year planning horizon. It is not to be construed as a zoning (regulatory) map, which the Town may employ to achieve the desired development depicted on Future Land Use Map.*
2. *While development on pre-existing lots may occur at higher densities than shown on the Future Land Use Plan, pro-active efforts to address or avoid runoff, drainage and sewage problems in existing densely developed neighborhoods may reduce development densities.*
3. *Designation of an acceptable residential density for an area may indicate a parcel-wide or a neighborhood-wide average and some areas may be developed at higher densities ("cluster") in order to preserve other areas as open space.*
4. *To implement the Comprehensive Plan, it is anticipated that the zoning map and the zoning regulations will be revised in accordance with the Rhode Island Zoning Enabling Act to carry out the land use goals of the Plan. The principal goals which the Town strives to achieve through this Comprehensive Plan are to preserve and enhance the unique seaside character of the Town and to provide a satisfying, healthy and supportive environment for all residents of the Town.*

1.5 PLANNING PROCESS

This plan is an update of the 2005 Town of Narragansett Hazard Mitigation Plan (HMP). The town's previous plan was adopted on July 18, 2005. The two main arenas for outside input in updating the Town of Narragansett's Hazard Mitigation Plan were the Mitigation Planning Committee appointed by the Town Manager and Public Participation. The planning process afforded the committee access to the knowledge of relevant professionals in Narragansett. The public participation component used public meetings, and public review to gain firsthand knowledge of local issues and get feedback throughout the process.

Local Hazard Mitigation Committee 2011

Grady Miller, Town Manager

Michael DeLuca, Planning Director

James Cotter, Fire Chief/EMA Director

Dean Hoxsie, Police Chief

David Ousterhout, Director of Public Works

Jeffrey Ceasrine, Town Engineer

Tony Santilli, Building Official

The Disaster Mitigation Act planning regulations and guidance stress that each local government seeking FEMA approval of its mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the Hazard Mitigation Planning Committee (HMPC),
- Detail areas within the planning area where the risk differs from that facing the entire area,
- Identify specific projects to be eligible for funding, and
- Have the governing board formally adopt the plan.

For the Town of Narragansett Mitigation Plan's HMPC, "participation" in the update meant:

- Attending and participating in the HMPC meetings,
- Providing available data requested of the HMPC,
- Reviewing and providing comments on the plan drafts,
- Advertising, coordinating, and participating in the public input process, and
- Coordinating the formal adoption of the plan by the governing boards.

The Planning Committee used FEMA's 10-step planning process integrating recommendations from FEMA's Local Multi-Hazard Mitigation Planning Guidance (2008), the Local Mitigation Planning How-To Guides, and the 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. The Table below shows how the modified 10-step process corresponds with the planning requirements of the Disaster Mitigation Act.

Disaster Mitigation Act Requirements 44CFR 201.6	Modified CRS Planning Steps
1 Organize Resources	
201.6(c)(1)	1 Organize the Planning Effort
201.6(b)(1)	2 Involve the Public
201.6(b)(2) and (3)	3 Coordinate with Other Departments and Agencies
2 Assess Risks	
201.6(c)(2)(i)	4 Identify the Hazards
201.6(c)(2)(ii)	5 Assess the Risks
3 Develop the Mitigation Plan	
201.6(c)(3)(i)	6 Set Goals
201.6(c)(3)(ii)	7 Review Possible Activities
201.6(c)(3)(iii)	8 Draft an Action Plan
4 Implement the Plan and Monitor Progress	
201.6(c)(5) 9 Adopt the Plan	
201.6(c)(4) 10 Implement, Evaluate, and Revise the Plan	

Source: FEMA Local Multi-Hazard Mitigation Planning Guidance, 2008

The purpose of the Hazard Mitigation Planning Committee is to guide the Hazard Mitigation Plan update process. The Committee was led by Town Planner, Michael DeLuca and was comprised of one or more representatives from several Town departments including Police, Fire, Planning Department, Emergency Management, the Town Engineer and Public Works. There were several planning meetings held between September 2010 and November 2011.

The LHMC met from September 2010 and June 2011 to conduct initial in-house research, draft a Request for Proposals for a consultant, and review the existing plan. The first meeting with the consultant followed the initial phase of research. The Town of Narragansett, through competitive bidding, hired Maguire Group to facilitate the hazard mitigation plan update. The kick-off meeting with the consultant occurred on June 17, 2011. At this meeting the LHMC reviewed the goals and objectives, discussed the planning process, and identified the strategy for the update of the plan. The committee discussed the current plan, presented data on potential hazards, demographics, municipal capabilities, and the process of hazard mitigation planning. The main goal of the first meeting was to set the scope for the remainder of the project.

Based on their experience and local knowledge, the committee members narrowed the scope of research to the topics of greatest relevance to Narragansett. This included ranking the particular hazards that should receive most attention during the update process. The Hazard Mitigation Planning reviewed and updated each of the sections of the previously approved plan, including improving organization and formatting and adding substantially more in-depth information specific to the Town of Narragansett. Sections that were updated include Planning Process, History/Profile of Hazards, Vulnerability and Risk Assessment, Mitigation Goals and Actions, Plan Maintenance and Maps.

At the second meeting on July 11, 2011, the LHMC began addressing the current status of the mitigation actions in Vulnerable Area One and discussed the hazards that affect the Town. The LHMC conducted the Risk Assessment to determine the risk level and risk rating for each hazard. The third meeting, on July 21, 2011, was an opportunity to discuss the current status of the mitigation actions in Vulnerable

Areas Two and Three. The LHMC added Route 1A to Vulnerable Area Three. It was also determined that Vulnerable Area Fifteen (Day Care Center) could be deleted because the day care had moved and it was no longer a vulnerable area for the Town. All of the actions in that section would also be deleted. The LHMC also decided to delete Vulnerable Area Seven (Bridge: Potter Salt Pond) because that location is in the Town of South Kingstown and is not a vulnerable area for the Town of Narragansett. The Town will support relevant mitigation actions that the Town of South Kingstown may decide to pursue but will not be seeking any funding or pursuing any mitigation actions on their own. All of the corresponding mitigation actions were deleted.

The following planning meeting occurred on August 4, 2011. The LHMC continued addressing the current status of the mitigation actions. They also reviewed the remaining hazard profiles and began a list of people to invite to the public meeting. The planning meetings that occurred on September 12 and 23, 2011 were utilized to finish reviewing the mitigation actions and to prepare for the public meeting. The Public Meeting was held on October 13, 2011. Representatives from South Kingstown and the Rhode Island Coastal Resource Management Council attended and offered input. Both attendees had been sent personal invitations. On November 2, 2011, the LHMC reviewed the notes from the public meeting and incorporated the comments into the plan. Also, the LHMC finalized the mitigation actions and discussed the completion of the draft plan.

The LHMC deleted several vulnerable areas. The LHMC eliminated Vulnerable Area 7: Bridge: Potter Pond Bridge/Succatosh Road, Vulnerable Area 13: Fisherman's Memorial Park, Vulnerable Area 14: Beechwood Apartments, and Vulnerable Area 15: Day Care. Bridge: Potter Pond Bridge/Succatosh Road was deleted because it is located in South Kingstown. Fisherman's Memorial Park was deleted because it is state owned and maintained. Beechwood Apartments is a private entity and the evacuation actions are covered under emergency management activities already ongoing by the Town with the Special Needs Registry and early evacuation/notice to elderly and special needs residents. Lastly, the Day Care Vulnerable Area was deleted because the day care has moved locations and is no longer in a floodplain.

In between meetings the LHMC reviewed material sent to them by Maguire Group on the hazard profiles, capability assessment, and other components of the plan. New information databases were compiled to address climate change. The members of the LHMC assisted Maguire Group in updating information since 2005.

1.5.1 PUBLIC PROCESS

In order to maximize the effectiveness of this LHMC, the Team sought continual public engagement. Public input was encouraged during two phases of the document development. The first opportunity for involvement was at the public meeting, held in the Town Hall on October 13, 2011. The public meeting provided more information about community knowledge and the existing vulnerabilities and capabilities. Finally, after the Town of Narragansett reviewed the Hazard Mitigation Plan update, the document was available for public comment. The document was posted on the Town's web page and at several locations with opportunities for anonymous feedback. Public inputs from all phases of the Plan development were incorporated into the final document.

1.5.2 PUBLIC PROCESS GOALS

The goal of the public process was to solicit “ground-level” information about Narragansett. The intent was to gauge household and business preparedness and awareness of personal mitigation techniques, identify areas where people were particularly vulnerable, and get feedback on potential mitigation strategies. When possible, we provided respondents with information that would be useful in personal preparedness activities.

1.5.3 PUBLIC MEETING PROMOTION

The meeting was promoted via notice in September 28, 2011 in the *Narragansett Times*, the local weekly newspaper. The LHMC also compiled a list of individuals to invite. The Town sent personal invitations to the Town of South Kingstown, the Town of North Kingstown, Bonnet Shores Fire District, Rhode Island Emergency Management Agency, Rhode Island Department of Environmental Management, Coastal Resource Management Center, and United Water.

1.5.4 PUBLIC MEETING ACTIVITIES

The public meeting was sparsely attended. A presentation was prepared to discuss the plan updates, which included a more thorough analysis of hazards and a review of vulnerable areas and mitigation activities. This presentation is included in Appendix C, Public Outreach.

1.5.5 DOCUMENT REVIEW

After the Project Team completed the final draft of this Hazard Mitigation Plan update, it was sent through several review phases. The public was given the opportunity to comment on the Hazard Mitigation Plan, prior to sending it to the State and FEMA for approval. The document was available on the Town of Narragansett’s web page and at public locations. Physical copies of the document were available at Town Hall and the Public Library. Copies were also sent to the neighboring communities for comment.

The document review process followed the schedule below:

June 2011 – November 2011: Town of Narragansett LHMC Planning Meetings and Review

October 13, 2011- First Public Meeting

November 15, 2011 – December 2, 2011 – Town of Narragansett Department Review of updated plan

December 7, 2011 – December 21, 2011- Public Review

XXXXXX - Rhode Island State Review

XXXXXX – FEMA Review

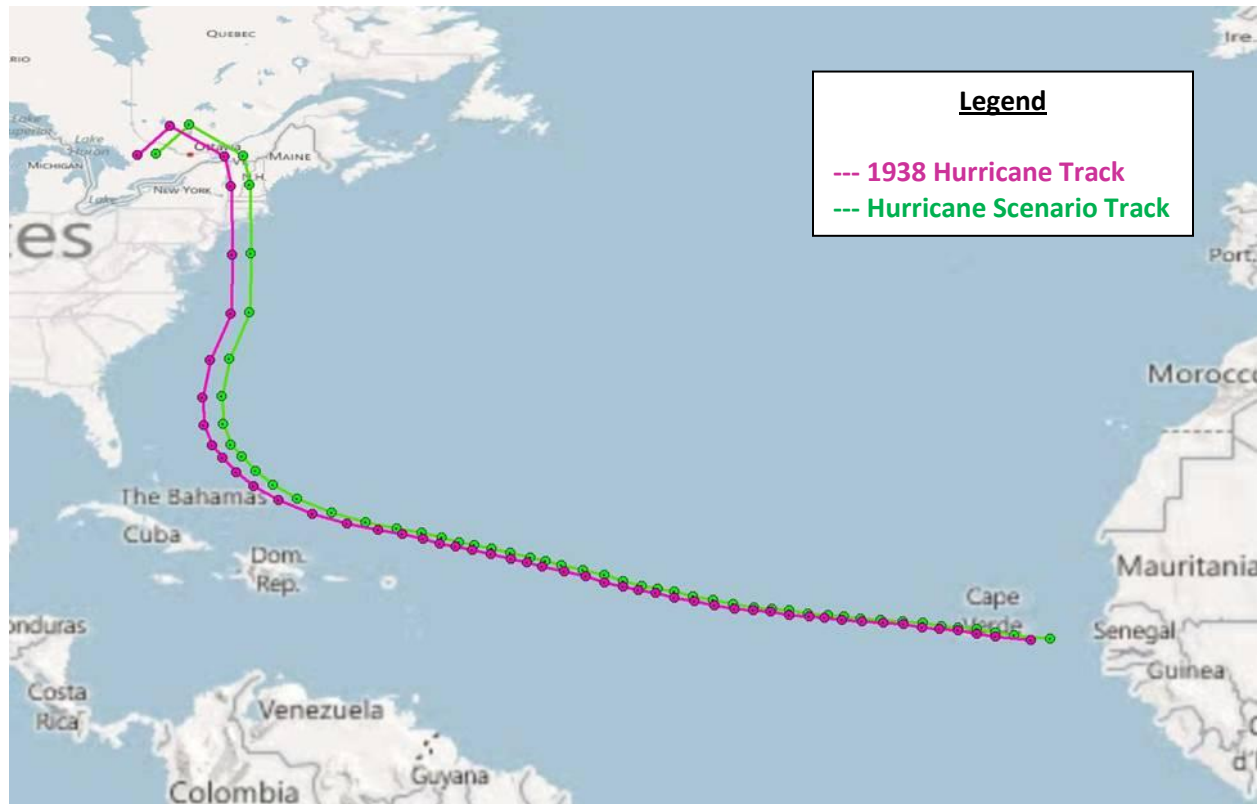
1.5.6 SCENARIO

For planning purposes including the Town’s preparation for debris generation after a hurricane, and for HAZUS modeling, the following scenario was used:

A large hurricane developed in the far eastern Atlantic, near the Cape Verde Islands on September 4. It moved west across the Atlantic and turned north on the 12th accelerating up the Eastern Seaboard at 60mph on a track that would bring it directly over Westerly, Rhode Island. This hurricane was a strong

Category 3 storm. The center made landfall at the time of astronomical high tide, moving north. The track of the storm takes it approximately 20 miles west of Narragansett, almost the same track of the Hurricane of 1938. Below is a map depicting the 1938 Hurricane and also the track used in the Hazard Mitigation Plan update. The purple line is the 1938 Hurricane Track and the green line is the Hurricane Scenario Track.

Hurricane Scenario Track vs. 1938 Hurricane



2.0 HAZARD RISK ASSESMENT

Risk includes the characteristics of the hazard and takes into account the magnitude, duration, distribution, area affected, frequency and probability of an event. This section focuses on assessing the community's risk to natural hazards by identifying which natural hazards affect Narragansett, by reviewing Narragansett's and the State of Rhode Island's hazard history. This section also takes a look at Narragansett's capabilities and the mitigation efforts that the town currently has in place.

2.1 HAZARD PROBABILITY

In order to comprehensively assess the relative risk posed by hazards, the LHMC developed a model that considers both the frequency and vulnerability to the hazards. The objective of the rating system is to identify which hazards pose the greatest risk to the Town of Narragansett. In order to comprehensively assess the relative risk, the model considers the frequency and the vulnerability of each hazard. The model deals with hazards and risk in a relative manner and the risk rankings are to be considered within this

context. Frequency and vulnerability were given equal weighting. Specifically, the model uses the following simplified equation:

$$\text{Risk} = \text{Frequency} \times \text{Vulnerability Factor}$$

Frequency

The hazard frequency was determined for each hazard using a 0-3 scale:

0 Hazard is unlikely to ever occur in Narragansett

1 Hazard may occur every ten to fifty years

2 Hazard may occur every generation

3 Hazard will occur with some regularity

Vulnerability Factor

A vulnerability factor was used to address the various vulnerabilities and the severity of a hazard. The built environment, systems (transportation, utilities, economy, etc.), natural systems, the human population and severity were each assigned a zero to three value. In order to equally weight frequency and vulnerability, the average of the vulnerabilities provided a “vulnerability factor.” The vulnerability ratings used the following equation:

$$\text{Vulnerability Factor} = (\text{Human} + \text{Built} + \text{Natural} + \text{Systems} + \text{Severity})/5$$

The vulnerability factor was then classified on a 0-3 scale:

0 The vulnerable population or system will not be affected

1 Event causes some mild disturbances to some systems, buildings, natural environment or populations

2 Event causes some mild disturbances to all systems, buildings, natural environment or populations OR event causes severe disturbance to some systems, buildings, natural environment or populations

3 The entire Town is significantly affected by the event

Based on the information provided about each of the hazards, the assessment used the following equation to complete the Hazard Rating Chart:

$$\text{Risk} = \text{Frequency} \times (\text{Human} + \text{Built} + \text{Natural} + \text{Systems} + \text{Severity})/5$$

Due to the variability inherent in each of the hazards and the rating system, the risks were divided into categories of low, moderate and high-risk hazards. The relative ranking established by this model provided a framework for the risks and strategies addressed in the Hazards Mitigation Plan.

RISK ASSESSMENT MODEL

Event	Frequency	Vulnerability					Vulnerability Factor	Risk Rating	Risk level
		Built	Natural	Systems	Populations	Severity			
Possible Rankings	0-3	0-3	0-3	0-3	0-3	0-3			
Severe Storms	3	1	1	3	2	2	1.8	5.4	High
Hurricane	2	2	2	2	3	3	2.4	4.8	High
Heat Wave	3	0	2	2	2	2	1.6	4.8	High
Flooding and Dam Failure	3	1	1	1	1	1	1	3	Medium
Tornadoes	1	2	2	2	2	2	2	2	Medium
Earthquake	1	2	1	2	2	2	1.8	1.8	Low
Drought	2	0	1	1	1	1	0.8	1.6	Low
Wildfire and Conflagration	1	2	1	1	1	1	1.2	1.2	Low

The LHMC discussed manmade hazards and though they could have potential impacts to the community, decided not to include them in the plan and would instead continue to include references and standard operating procedures within the Narragansett Emergency Operations Plan. The LHMC also decided not to profile wildfire and conflagration. The Town understands that it is a potential hazard to the community but it ranked the lowest in the matrix and therefore the LHMC will not profile it at this time.

2.2 NARRAGANSETT: GEOGRAPHY, HAZARDS AND HISTORY

Narragansett, a part of Washington County, is located in southern Rhode Island on the east bank of the Pettaquamscutt River to the shore of Narragansett Bay. The Town is bordered by the communities of North Kingstown and South Kingstown.

2.2.1 SEVERE WEATHER

Severe Weather Profile

Severe weather and hurricanes are the primary hazards affecting Rhode Island. Severe weather includes nor'easters, winter storms, ice storms, severe thunderstorms, and tornadoes. These hazards can result in flooding and high winds causing damage to residential homes, businesses, historical buildings, dams, bridges and other critical infrastructure.

The trajectory of these systems determines the local effect. Storms with a southern origin bring heavy rain. Storms coming from the north bring cold air and the potential for snow and ice. Any winter storm, regardless of its trajectory, can be accompanied by high winds. Storms with sustained winds above 30 mph generally cause low impact, widespread damage, while winds above 50 mph are powerful enough to cause significant damage.

Climate change predictions indicate that storms in the Northwest are likely to occur more frequently and be more severe. Although Narragansett does not typically experience more than a week of snow each year, it is likely that these events will become more common. Narragansett can expect to receive more ice and snow in the winter months.

Location

The entire Town of Narragansett may be affected by a severe storm; however, microclimates within the Town may increase the vulnerability in specific areas. Narrow culverts are vulnerable to ice jams and hilltops are subject to lightning.

Timing and Duration

With the exception of hurricanes, most severe storms in Narragansett occur between November and April when the jet stream moves over the East Coast when low-pressure systems are more frequent. Storms can last anywhere from a few hours to several days. Weather forecasting abilities will provide Narragansett, at minimum, a few hours warning prior to an extreme weather event.

Severity

Storms in Narragansett are likely to have a severity of low to moderate. Historically, storms have been relatively short in duration and have had mostly localized impacts. The main concern about a severe storm in Narragansett is the potential to isolate citizens and businesses if roads are blocked by snow, ice, wind, and flooding in low-lying areas. This may cause some financial hardships for the Town, but it is unlikely to cause widespread, permanent damage or loss of life. It is important to note that windstorms are also associated with storm surges of one to three feet.

Frequency

Severe storms are not common in Narragansett. Snow, ice, rain, and wind do occur but do not typically rise to the level of severe. Washington County has reportedly experienced at least one serious windstorm per calendar year.

Severe Weather History

The majority of Rhode Island lies outside the heavy snow and ice regions of the northeast. Due to its maritime climate, Rhode Island generally experiences cooler summers and warmer winters than inland areas. However, snow and ice do occur and can result in more extensive damage than one would expect. The two major threats from these hazards are loss of power due to ice on electrical lines and snow loading on rooftops. One of the most memorable winter storms was the “Blizzard of ’78” which stalled over Lincoln, RI. The storm delivered 24 to 38 inches of snow. Motorists abandoned their cars on Interstate

Highways and local roads. The governor declared a state of emergency, closing highways and businesses for the week required to remove snow.

Recent blizzards and major snowstorms occurred in 1993, 1996, 1997, 2001, 2005, 2006, 2010, and 2011 causing millions of dollars in damage, many collapsed roofs, the loss of power in some areas for days and the loss of life. The Blizzard of '96 brought 27 inches of snow, the largest accumulation recorded, to Narragansett. This severe storm disrupted transportation systems, closed schools/businesses, and damaged commercial and residential property throughout the town. During the following week, several commercial and residential roofs collapsed. The Blizzard of '06 brought over 24 inches of snow in a relatively short period of time. No serious structural damage was reported in Narragansett. The Governor declared a state of emergency closing all Town and State facilities. Roads remained open for emergency vehicles. Businesses and public services returned to normal operations within 48 hours.

Table 1 – Precipitation in Inches for Coastal Washington County*

Year	Total Precipitation	Total Snow Accumulation
2007	48.00	22.4
2008	70.79	39.0
2009	63.87	58.5
2010	67.28	34.2

Source: Rhode Island Department of Environmental Management,
Courtesy of Lenny Guiliano, Senior Air Quality Specialist/Meteorologist
*Weather station located in South Kingstown

Wind events are quite normal in Southern New England and happen regularly each year. In the winter months the area is susceptible to high winds from Nor'easters and winter storms. Spring and summer seasons usually bring a number of severe thunderstorms to the region. During the late summer and fall seasons the area is at risk from hurricane winds.

Narragansett and Washington County have experienced ten significant windstorms over the past ten years. Exact amounts of property damage are unknown for Washington County and Narragansett; however, damage to vehicles and buildings was reported. Major wind damage has been related to tree and branch damage. On occasion the trees and branches have caused structural damage.

2.2.2 HURRICANES

Hurricane Profile

“A ‘tropical cyclone’ is the scientific term for a closed meteorological circulation that develops over tropical waters. These large-scale non-frontal low-pressure systems occur throughout the world over zones referred to as ‘tropical cyclone basins’”¹. In the northeast they are known as hurricanes.

Hurricanes begin as tropical depressions in their formative stages. If the sustained velocity of the winds exceeds 39 mph it becomes a tropical storm. Once the tropical depression becomes a tropical storm it is considered a threat it is given a name. When the winds exceed 74 mph, the system then becomes a hurricane. Most tropical depressions begin off of the coast of Africa near the Cape Verde islands or near the Caribbean as the sea surface temperature is above 81 degrees Fahrenheit in the summer months which assists in system formation. Tropical storms and hurricanes then will travel a path that may take them up the east coast thus impacting Rhode Island and Narragansett.

While there is a low probability that the Town will be significantly impacted by a hurricane in the next five years, one direct hit on the State of Rhode Island could be catastrophic for all of the cities and towns. The Town was impacted by a hurricane several times throughout the past century, all of which are referenced in Table 6.



On the next page is the Saffir-Simpson Scale which was “developed in the early 1970s by Herbert Saffir, a consulting engineer in Coral Gables, Florida, and Dr. Robert Simpson, then director of the National Hurricane Center. The scale is based primarily on wind speeds and includes estimates of barometric pressure and storm surge associated with each of the five categories. It is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall.”²

TABLE 2 - SAFFIR-SIMPSON HURRICANE SCALE

¹ Neumann, C.J., et al. Tropical Cyclones of the North Atlantic Ocean, 1871-1986 (Washington, D.C.: U.S. Department of Commerce, NOAA, 1987).

² Hurricanes and Tropical Storms: Saffir-Simpson Hurricane Scale" *Weather.com*. The Weather Channel, 1995-2001.

Category	Central Pressure		Winds		Damage
	Millibars	Inches	(mph)	(kts)	
1	>980	>28.9	74-95	64-83	Minimal
2	965-979	28.5 - 28.9	96-110	84-96	Moderate
3	945-964	27.9 - 28.5	111-130	97-113	Extensive
4	920-944	27.2 - 27.9	131-155	114-135	Extreme
5	<920	<27.2	155+	>135	Catastrophic

Wind damage is a concern with hurricanes and tropical storms. Wind pressure, and not wind speed are what causes wind damage. There are three different types of wind pressure: positive, negative, and internal.

As referenced in the State Hazard Mitigation Plan of 2008 on page 52:

- *Positive wind pressure* is what one feels when the wind is blowing in one's face. It is the direct pressure from the force of the wind that pushes inward against walls, doors and windows.
- *Negative wind pressure* occurs on the sides and roof of buildings. It is the same pressure that causes an airplane wing to rise. This negative pressure is also known as lift. Negative pressure causes buildings to lose all or a portion of their roofs and side walls, and pulls storm shutters off the leeward side of a building.
- *Interior pressure* increases dramatically when a building loses a door or window on its windward side. The roof feels tremendous internal pressures pushing up from inside of the building together with the negative wind pressure lifting the roof from the outside.

It is the windborne debris that causes a lot of the damage. Flying objects such as tree limbs, outdoor furniture, signs, roofs, gravel, etc. In coastal flood zones, however, storm surge causes far more damage than wind damage.

Location

The entire Town of Narragansett may be affected by a hurricane; however, microclimates within the Town may increase the vulnerability in specific areas. Some areas will have significant impacts such as low-lying areas, which include the beaches. There are also public and private buildings located within the



FEMA velocity zones and coastal A zones. The highest storm surges and most extensive damage, however, will result from the storm surge if the hurricane's eye is to the west of the Town of Narragansett.

Timing and Duration

Hurricane season is between June 1 and November 1 each year. Hurricanes typically affect the northeast from August through October when the waters are the warmest. Statistically the peak of the season is September 10. The severity and speed of a hurricane will determine how long the inclement weather will affect the Town. The amount of time a hurricane or tropical storm will affect the Town depends on its size in diameter and the forward speed. Historically these storms increase their forward speed as they approach northern latitudes. To calculate the duration of a storm, divide the forward speed of the storm into its diameter, the total is the amount of time that the Town will be impacted by the storm. Weather forecasting allows typically a few days advanced warning of the onset of a hurricane that will affect Narragansett, but is plagued with much uncertainty about the exact track of the storm. This uncertainty makes it difficult to plan for "worst case scenario."

Severity

Hurricanes in Narragansett are likely to have a severity of low to moderate. This would depend on the location of the eye of the hurricane or tropical storm. The rain and winds could cause severe damage depending on the severity of the winds and amount of rain. Debris would most likely be the biggest issue if the Town was impacted by a hurricane. Downed trees and power lines could isolate people within the Town from emergency response personnel. The hurricanes severity will be higher if the eye passes to the west of the Town. Storm surge will be more intense and cause extensive damage. If the storm passes to the east of the Town, the effects will be more like a nor'easter, however, in a storm with very little rain and more winds, the salt spray can cause widespread power outages that can last upwards of a week.

Frequency

FEMA considers hurricanes in New England a low-frequency, high-impact event. Though they do not occur often, when they do, they leave their mark.

Hurricane History

Southern New England has been affected by 40 tropical weather systems since 1900; 25 hurricanes and 15 tropical storms. Nine of the 25 hurricanes made landfall along the southern coastline of Rhode Island and Massachusetts. In 1954, New England endured three hurricanes; Carol, Edna, and Hazel. Over the last seventy-five years Rhode Island was directly affected by six storms which had hurricane force winds at landfall. These included three Category 3 hurricanes directly impacting Rhode Island and causing millions of dollars in damage and hundreds of



deaths. The most recent hurricane to directly impact Rhode Island was hurricane Bob in 1991, a Category 2 hurricane.

Although Rhode Island has not been hit by intense hurricanes (Category 4 or 5) as seen in other parts of the East Coast, we have had our share of major hurricanes that have caused extensive damage to the State. In the sixteen year period from 1938 to 1954, Rhode Island experienced three major hurricanes that caused a tremendous amount of damage and resulted in almost 300 deaths across the State. The great unnamed hurricane of 1938 devastated Rhode Island and caused \$100 million (in 1938 dollars) in property damage and took 262 lives. Damage included flood losses for harbor structures, commercial, and residential property. Hurricane Carol in August of 1954 caused similar damage dollar wise, but thankfully only resulted in the loss of 19 lives.

Table 3: Major Rhode Island Hurricanes

Hurricane	Category	Wind Speed at Landfall	Damage to Rhode Island
Hurricane of 1938	3	Sustained to 91 MPH, gusts to 121 MPH	Extensive – roofs, trees, crops; storm surge 12 to 15 ft. destroyed coastal buildings
Carol, 1954	3	Sustained to 100 MPH, gusts to > 125 MPH	Westerly to Narragansett coast communities were wiped out; downtown Providence under 12 feet of water; 14 ft. storm surge in upper bay
Edna, 1954	2	Sustained to 95 MPH, gusts to 110 MPH	Inland flooding; rivers rose several feet above flood stage; knocked out electrical power
Donna, 1960	3	Sustained to 95 MPH, gusts to 130 MPH	Moderate storm surge; extensive beach erosion; wind damage to trees and utility poles causing major power outages
Gloria, 1985	2	Sustained to 81 MPH, gusts to 100 MPH	Minor coast flooding and erosion; scattered power outages
Bob, 1991	2	Sustained to 100 MPH, gusts to > 105 MPH	Storm surge of 5-8 feet; extensive beach erosion; wind damage to trees and utility poles; 60% of southeast RI lost power

Hurricane Bob, in 1991, was one of the costliest hurricanes to hit New England. The major damage was caused by wind and flooding was minimal. Debris blocked roads and caused extensive structural damage. The hurricane winds caused power outages that lasted for a period of about 72 hours. Damage from Hurricane Bob was reported in the millions. The other major Rhode Island hurricanes had little destructive impact on Narragansett.

Tropical Storm Irene

Tropical Storm Irene impacted the Town of Narragansett on August 28-29, 2011. The Town experienced storm surge, debris, and minimal flooding. The Town did not suffer major physical damage; however, there were a lot of downed trees and power outages. Two buildings were inspected, the parks and

recreation maintenance facility's roof was damaged by a downed tree, beach cabana facilities lost several roof and sidewall panels, and the access ramp to the beach pavilion was shifted. Boston Neck Road was closed for two days after the storm due to overwash from the Narragansett Town Beach.

2.2.3 HEAT WAVE

Heat Wave Profile

A heat wave occurs when a system of high atmospheric pressure moves into an area. In such a high-pressure system, air from upper levels of our atmosphere is pulled toward the ground, where it becomes compressed and increases in temperature.

This high concentration of pressure makes it difficult for other weather systems to move into the area, which is why a heat wave can last for several

days or weeks. The longer the system stays in an area, the hotter the area becomes. The high-pressure inhibits winds, making them faint to nonexistent. Because the high-pressure system also prevents clouds from entering the region, sunlight can become punishing, heating up the system even more. The combination of all of these factors come together to create the exceptionally hot temperatures we call a heat wave.

The National Weather Service (NWS) provides alerts when Heat Indices approach hazardous levels. Figure 9 provides the alert procedures for the National Weather Service. In the event of an extreme heat advisory, The National Weather Service does the following:

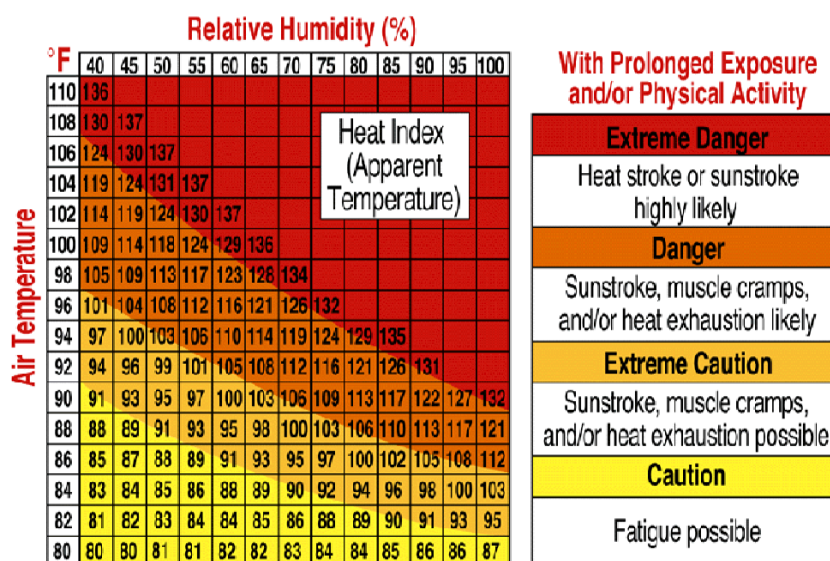
- Include heat indices (HI) values and city forecasts;
- Issue special weather statements including who is most at risk, safety rules for reducing risk, and the extent of the hazard and HI values;
- Provide assistance to State/Local health officials in preparing Civil Emergency Messages in severe heat waves.

Location

Heat waves can occur in almost any place in the world typically during the summer months.

Timing and Duration

A heat wave typically lasts for two or more days and usually occurs anywhere between June and August.



Severity

Temperatures that hover 10 degrees or more above the average high temperature for a region, and last for several weeks, constitute an extreme heat event.

Frequency

Previous Occurrences

Table 4 – Previous Occurrences of Heat Wave in Rhode Island

Year	Description
2010	The weather pattern for July 2010 was dominated by the North Atlantic High over much of the eastern and southern United States. Causing a heat wave to blanket the State of Rhode Island, July temperatures averaged warmer than normal along most of the country east of the Mississippi River. With July 2010 ranking as the warmest July between 1895 – 2010, it was a record for Rhode Island.
2008	June of 2008 saw a heat wave lasting three days with temperatures soaring above 95 degrees, breaking records set the previous year.
2007	In August 2007, a heat wave gripped Rhode Island sending temperatures above 90 degrees, lasting for 2 days.
1999	The summer of 1999 saw a devastating heat wave and drought in the eastern United States. Rainfall shortages resulted in the worst drought on record for Maryland, Delaware, New Jersey, and Rhode Island.

*This chart is only referencing heat waves in the past 13 years.

Probability of Future Events

At this time, it is impossible to stop an Extreme Heat event. Therefore, mitigation activities should be tailored towards protecting lives and preventing injury from an Extreme Heat event.

2.2.4 FLOODING AND DAM FAILURE

Flooding and Dam Failure Profile

Flooding

As found in the Rhode Island State Hazard Mitigation Plan (2008), “A flood, which can be slow or fast rising but generally develops over a period of days, is defined by the National Flood Insurance Program as:

- A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; or a mudflow; or the

- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion of undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

By their very nature, floodplains are the low, flat, periodically flooded lands adjacent to rivers, lakes and oceans and subject to geo-morphic (land-shaping) and hydrologic (water flow) processes. It is only during and after major flood events that the connections between a river and its floodplain become more apparent. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater. When a river is divorced from its floodplain with levees and other flood control structures then natural benefits are either lost, altered, or significantly reduced.”

Dam Failure

As defined by NOAA, a dam is “any artificial barrier that diverts or impounds water.” NOAA defines dam failure as a “catastrophic event characterized by the sudden, rapid, and uncontrolled release of impounded water.”³

Location

Floodplains in Narragansett include “A”, “V” and “X” zones. “A” zones are areas that would be inundated by the 100 year flood. Coastal A Zones are treated the same as Riverine A Zones.

“The A Zone is that portion of the SFHA that is not subject to high velocity wave action during the base flood and is not designated as Zone V due to primary frontal dune considerations. The source of flooding in an A Zone can be a stream or river that overflows its banks; a lake; or coastal storm surge accompanied by wave heights and wave runup depths less than 3 feet.”⁴ “V” zones are Velocity zones that are subject to breaking wave action where as waves greater than 2.9 feet are forecasted during the 100 year flood or storm surge. “X” zones are areas that would be inundated by the 500 year flood. About 40% of the Town is located in flood zones, (including zone “X”). Map 4 depicts the FEMA flood zones. The only significant hazard dam is Sprague Pond located at Kingstown Road, however this dam would no significant impact because there is no developed property below the dam.

Pettaquamscutt Terrace, portions of the center of town, and Caswell Street all have reoccurring flood issues. The Town of Narragansett is a member of the National Flood Insurance Program (NFIP) as well as the Community Rating System (CRS). Narragansett currently has a rating of eight (8) in the CRS which affords all homeowners with flood insurance to receive a ten percent (10%) discount on their premium. FEMA updated the Town’s Digital Flood Insurance Rate Maps (DFIRMS) on October 19, 2010. Amendments to Section 4.7 (Special Flood Hazard Area Overlay District) were voted on and approved at the October 4, 2010 Town Council meeting. These amendments included the reference to the October 19, 2010 DFIRMS.

Timing and Duration

³ "Glossary: Dam" NOAA's National Weather Service, 25 June 2009.

⁴ “CRS Credit for Coastal A Zone Regulations.” <http://training.fema.gov/EMIWeb/CRS/>

Weather forecasts and the close monitoring of local water systems normally provide substantial warning prior to flooding. 50% of Narragansett’s annual precipitation typically occurs in the four-month period from October through January and 75% occurs in the six-month period from October through March.

Groundwater seepage, storm water runoff and coastal storms cause most of the flooding in Narragansett.

Since the wet season is the typical time for these issues, the Town usually has adequate time to prepare. Hurricane warnings usually occur several days before impact and knowledge gained from past occurrences can also help localized areas of flooding prepare for future events. Dam failure can happen over several years or it can happen in a matter of moments. With proper inspection and maintenance, a dam will be less likely to fail.

The duration of a flooding event may be limited to a few hours or may extend for several days or even weeks.

Severity

Though frequent, flood events in Narragansett are not particularly severe. According to the FEMA 100-year flood depth grids, the majority of the floodplain will become inundated by only one foot of water. Since the 100-year floodplain is large, deep floodwaters are not a concern. Flood damage costs in Narragansett are typically low compared to other Washington County municipalities.

Although flooding in Narragansett tends to be shallow, water on roadways may cause significant road damage and limit access to important transportation routes or other services. While it is important to note that Narragansett is susceptible to large-scale severe flooding, any amount of water on a roadway will create significant problems for the Town, its residents, and those that are employed within its boundaries.

Should storm water drains become clogged and overflow into a permeable surface area (such as low impact development practices like permeable pavement, rain gardens, or infiltration trenches; or lawns and other landscaped areas), there is risk of groundwater contamination. The presence of hazardous materials within flooded areas increases the potential risk to the groundwater during flood events.

The severity of a dam failure is based upon the amount of water that the dam is holding back. A dam failure may not cause any problems downstream, or it could cause catastrophic issues.

Frequency

In recent years, the Town has experienced minor flooding almost annually. While such flooding may occur infrequently, groundwater seepage and stormwater drainage can be a consistent problem in rainy months. **Table 5, Past Occurrences of Flooding in Narragansett**, provides specific information about the location and extent of historical flooding.

Table 5 - Past Occurrences of Flooding in Narragansett⁵

⁵ As recorded by the National Climatic Data Center (NCDC) and reports from LHMC Committee

Date	Location	Type	Extent
October 2006	Boston Neck Road	Coastal	Localized flooding
April 2007	Narragansett Beach	Coastal	Localized flooding
March 2008	Narragansett Beach	Coastal	Localized flooding
July 2008	Woodruff Ave	Drainage	Localized flooding
August 2009	Scarborough Beach	Coastal	Localized flooding
March 2010	Narragansett	Riverine/Coastal/Drainage/Seepage	Several Streets and Basements flooded

March 2010 Floods

The State of Rhode Island experienced torrential rain fall that affected the entire state between March 12, 2010 and March 31, 2010. Two events caused immediate impacts to the Town of Narragansett. Crooked Brook flooded which caused Kingstown Road to be impassable for one day during the storm. Also, there was a failure of the Sprague Pond Dam outfall culvert. There were approximately 300 basements that flooded simply due to high groundwater.

Probability of Future Events

With climate change, increased ocean levels, storm water runoff, and the introduction of more impermeable surfaces, the frequency of localized flooding events is likely to increase. Climate change research suggests an increase of extreme weather patterns with wetter winters characterized by increased precipitation and intensity.⁶ The projected changes will increase the occurrence and severity of flooding events in Narragansett.

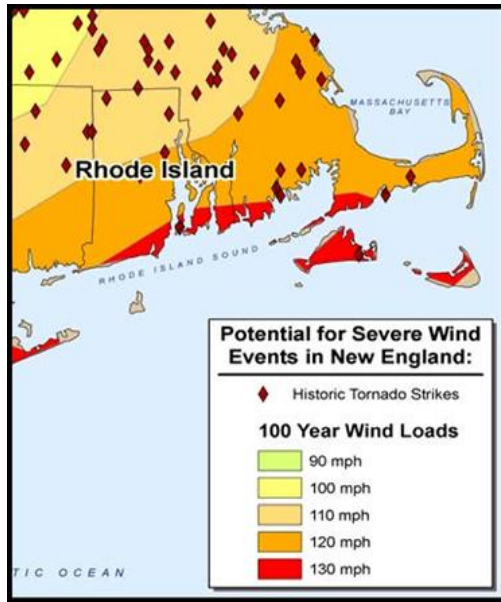
2.2.4 TORNADOES

Tornado Profile

The National Weather Service defines a tornado as a “violently rotating column of air extending from a thunderstorm to the ground.” Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour, and damage paths can be more than one mile wide and 50 miles long.

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) Scale. An updated and revised version of the Fujita scale is the Enhanced Fujita Scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis and better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado.

⁶ Climate Impacts Group: Joint Institute for the Study of the Atmosphere and Ocean



Location

A tornado can strike anywhere in Narragansett. The areas closest to the coast are more vulnerable to typically higher wind speeds. The map below depicts point locations of initial tornado touch down areas for the period of record (indicated by a red diamond). Also depicted on the map are 100 year wind loads in shaded gradients, the darkest hue of orange depicts 130 mph winds to the lightest hue depicts 90 mph wind loads. These wind loads are also used as building guidelines or “wind zones” in the state building code. Rhode Island is divided into three separate zones: 130 mph wind zone for some of the southern coastal areas; 120 mph for the middle portion of the state and remaining coastal regions; and 110 mph for the northern section of the state.⁷

Timing and Duration

Tornadoes can form any time during the year, but most form in May. Peak tornado season tends to be later in the year in the northern half of the country. Tornadoes can be spawned by hurricanes.

The duration of a tornado event may be limited to a few seconds or a few minutes.

Severity

Tornados can injure and kill people and livestock and destroy structures, infrastructure, and crops. The severity of a tornado is based on wind speed and the amount of property damage incurred. Due to their quick development and their unpredictable movement, tornados are difficult to respond to and protect lives.

Frequency

Rhode Island, however, ranks 49th out of 50 states for the occurrence of Tornadoes. Based on data from 1950 through 1995, the State had 8 tornadoes; there were 23 injuries and no fatalities. The total cost of tornadoes between 1950 and 1995 was \$1,979,656.00. There were reports of four tornadoes as Hurricane Bob came ashore in Rhode Island⁸. A devastating tornado occurred across the border in Worcester, MA in 1953. More than 90 people were killed and over 1,300 injured. Damage estimates were over \$52 million.

More recently, tornadoes impacted western Massachusetts. On June 1, 2011 an EF3 tornado impacted Springfield, Massachusetts. The tornado traveled from west to east through Westfield and Springfield before entering Monson, Massachusetts. The National Weather Service estimated winds speeds at 136 to 165 mph, the second strongest ever recorded in Massachusetts, causing over 175 million dollars in damages to Springfield.

⁷ 2005 State of Rhode Island Hazard Mitigation Plan

⁸ <http://www.erh.noaa.gov/box/hurricane/hurricaneBob.shtml>

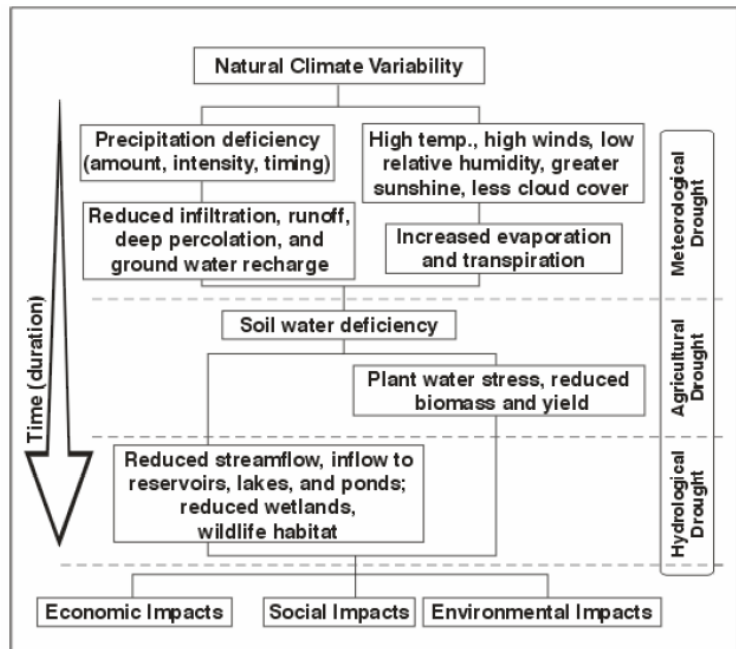
Table 6 - Major Rhode Island Tornadoes

Year	Tornadoes	Injuries	Adjusted Cost
1971	1	None	None
1985	1	None	None
1986	3	20	\$1,731,170
1989	1	3	\$127,511
1990	1	None	\$120,975
1994	1	None	None

2.2.4 DROUGHT

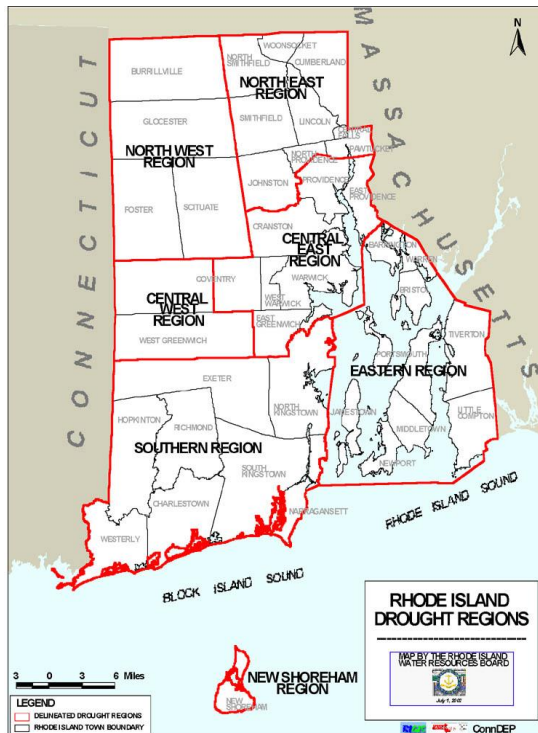
Drought Profile

“Drought is a natural hazard that evolves over months or even years, affects a specific area or an entire spatial region, and causes little structural damage. Generally, a drought can be defined as a continuous period of time in which rainfall is significantly below the norm for a particular area. This period could be as short as one summer, or as long as several years. Although the State of Rhode Island is often considered a “water-rich” state, it can experience extended periods of dry weather, from single season events to multi-year events such the long-term drought of the mid-1960s.”⁹



Droughts do not occur suddenly, which makes them a unique natural hazard. Instead, a drought evolves over months or even years, and while causing little structural damage, can have economic, environmental, and social impacts.

⁹ Rhode Island Drought Management Plan, RI Water Resources Board, June 2002.



Location

A drought will affect an entire region. Figure 11 shows the regions of the State as they are defined by the Rhode Island Drought Management Plan.

Since the whole Town of Narragansett relies on shared water sources, the entire Town will be affected by a drought. Past droughts in the Region have resulted in water use restrictions and higher water charges. Narragansett business and residents were consequently unable to adequately maintain landscaping. Water shortages cause loss of vegetation, including the parks located in the Town.

Timing and Duration

A short-term drought lasts anywhere from three to six months while long-term droughts can last for several years.

Severity

Droughts in the Northeast are likely to: reduce potable water supplies, provide inadequate stream flow volumes to support fish, increase the threat of wildfires, and pose a threat to vegetation that relies on natural precipitation. The severity of a drought can be reduced by water conservation technology and practices. The length of the recovery period is determined by the intensity of the drought, duration, and quantity of precipitation received as the drought recedes.

Frequency

Previous Occurrences

For the major historical drought events, the National Weather Service noted that the precipitation during the preceding fall and winter months was below-normal too much below-normal which is typically defined as ninety and seventy-five percent less than normal precipitation. Precipitation continued at below normal to much-below-normal levels through the spring and led to the most severe drought episodes, including the 1965-67 long-term droughts. The 1965-67 drought episodes lasted for three summers and included long periods of below-normal precipitation through the winter, spring, and summer months. This drought period serves as the classic model of a long-term drought in Rhode Island. Though short-term droughts, such as 1999, may not pose a significant impact for the state's public water systems, no water system will be immune to periods of long-term drought.

Table 7: Rhode Island Historical Droughts and Location of Impacts

Date	Area Affected	Remarks

1930-31	Statewide	Estimated stream flow about 70% of normal
1941-45	Statewide. Particularly severe in the Pawtuxet and Blackstone Rivers	Estimated stream flow about 70% of normal
1949-50	Statewide	Estimated stream flow about 70% of normal
1963-67	Statewide	Water restriction and well replacements common
1980-81	Statewide. Groundwater deficient in eastern part of State	Considerable crop damage in 1980
1987-88	Southern part of State	Crop damage, \$25 million

Probability of Future Events

Droughts are hard to predict, however, according to the Rhode Island State Hazard Mitigation Plan, there is a five percent (5%) chance of a drought in any given year, or a drought will occur every 20 years.

2.2.5 EARTHQUAKES

Earthquake Profile

The Rhode Island Hazard Mitigation Plan (2008) discusses earthquakes as follows:

An earthquake is caused by a sudden displacement within the earth. Displacement at relatively shallow depths may be caused by volcanic eruptions, or even by avalanches. The resultant earthquakes are usually light and do little damage. Strong and destructive earthquakes usually result from the rupturing or breaking of great masses of rocks far beneath the surface of the earth. The ultimate cause of these deep ruptures has not been established. All earthquakes produce both vertical and horizontal ground shaking. This ground movement begins at the focus or hypocenter, deep in the earth, and spreads in all directions. The motion we feel is the result of several kinds of seismic vibrations.

Geologists have found that earthquakes tend to reoccur along faults, which reflect zones of weakness in the Earth's crust. A *fault* is a fracture in the Earth's crust along which two blocks of the crust have slipped with respect to each other. Faults are divided into three main groups, depending on how they move. *Normal faults* occur in response to pulling or tension; the overlying block moves down the dip of the fault plane. *Thrust (reverse) faults* occur in response to squeezing or compression; the overlying block moves up the dip of the fault plane. *Strike-slip (lateral) faults* occur in response to either type of stress; the blocks move horizontally past one another. Most faulting along spreading zones is normal, along subduction zones is thrust, and along transform faults is strike-slip. Even if a fault zone has recently experienced an earthquake there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

The *focal depth* of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the *focus*). Earthquakes with focal depths from the surface to about 70 kilometers

(43.5 miles) are classified as shallow. Earthquakes with focal depths from 70 to 300 kilometers (43.5 to 186 miles) are classified as intermediate.

Liquefaction, which happens when loosely packed, water-logged sediments lose their strength in response to strong shaking, causes major damage during earthquakes.

Location

If an earthquake occurred it would likely impact the entire Town of Narragansett.

Timing and Duration

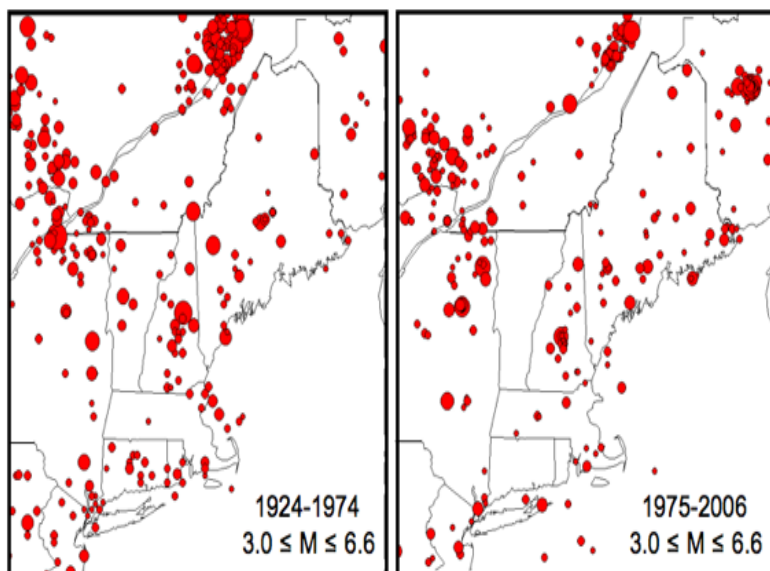
Earthquake shaking can last from less than 30 seconds to a few minutes. Secondary hazards could make the event last longer such as a fire or hazardous materials issue.

Severity

The severity of an earthquake would vary depending on the magnitude. An earthquake could have a very high impact for the Town.

Frequency

Earthquakes affect Narragansett approximately once every thirty years. See Figure 1 for a graphic representation of earthquakes that have affected New England.



Earthquake History in the Region

Earthquake History

Earthquakes in New England are a greater risk than most people realize. There have been 31 recorded earthquakes in this state over the last 220 years. Rhode Island can feel the effect of an earthquake occurring in the Northeast Region. Rhode Island has experienced several minor earthquakes in the last few years, but no extensive damage has occurred.

Two earthquakes are believed to have had their epicenters in Rhode Island:

- The February 1883, earthquake was felt from New London, Connecticut, to Fall River, Massachusetts. It was felt with an Intensity V from Bristol to Block Island.
- Another earthquake with a magnitude of 1.8 occurred in October 2003. The epicenter was determined to be 15 Miles SSW of Providence.

According to the RI Emergency Management Agency (RIEMA), experts believe that earthquakes are likely to strike the eastern half of the country within the next 50 years. The US Geological Survey

(USGS) estimates that there is a 40 to 60 percent chance of experiencing an earthquake of magnitude 6.0 or greater on the Richter Scale (1 to 10) in the central or eastern United States within the next 30 years.

No recorded earthquake history or damage is known to exist for Narragansett.

Table 8 – Levels of the Modified Mercalli Intensity

Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

2.3 CAPABILITY ASSESSMENT

The Town of Narragansett has initiated many studies and activities over the years that have laid the foundation for the development of this mitigation strategy. These include:

- ***Facilities Plan for Wastewater Management*** – adopted 2007; next update due 2012 – RIDEM jurisdiction – essentially a master plan for wastewater services. The plan serves as a capital improvement planning guide.
- ***Water Supply System Management Plan*** – adopted 2006, 2011 update is underway – RIDOH and Water Resources Board jurisdiction – also a master plan, however does include an emergency response section for natural and man-made hazards and threats.

- ***On-Site Vulnerability Assessment Training Report (Wastewater)*** – prepared by Applied Risk Management (ARM) 2002 – local jurisdiction; used for training and security improvements capital planning.
- ***On-Site Vulnerability Assessment Training Report (Water)*** – prepared by Applied Risk Management (ARM) 2003 – local jurisdiction; used for training and security improvements capital planning.
- ***Emergency Response Plan for the Town of Narragansett*** – prepared in-house; essentially a directory of critical resources and contact information, as well as basic response plan action items in the event of a natural disaster; last updated August 2010 and 2011 and has now been completed.
- ***Engineering and Public Works Departments Emergency Response Plan***– prepared in-house; essentially a directory of critical resources and contact information, as well as basic response plan action items in the event of a natural disaster – specifically tied to Engineering and DPW functions; last updated August 2010 and 2011 update has been completed.
- ***Emergency Operations Plan (EOP)*** – The Town’s Emergency Operations Plan is currently undergoing a 2011 update and is prepared in-house in partnership with Rhode Island Emergency Management Agency. The EOP is a plan to assist the Town during an all-hazards emergency in the implementation of the National Incident Management System and the Incident Command System. It outlines the Emergency Support Functions and general responsibility for certain functions. The EOP has a Severe Weather and Terrorism Annex.
- ***Medical Emergency Distribution System (MEDS) Plan*** – The Town’s MEDS Plan was last updated in 2011 in-house in partnership with the Rhode Island Department of Health. The plan is a guiding document for medical emergency distribution.

Narragansett implements and enforces the state building codes and currently participates in the Community Rating System (CRS) as well as the NFIP. The Town has participated in CRS since 1992 and currently has a rating off 8. All taxpayers receive ten percent (10%) off of their flood insurance due to the exercises performed under this program. To maintain their rating, the Town implements the following:

- Maintain flood elevations certificates for properties that are new are or substantially improved in the Special Flood Hazard Areas (SFHA),
- Outreach program where the Town mails pamphlets and correspondence to people in a flood zone areas,
- Documentation that the community continues to preserve open space areas located in the SFHA,
- Documentation that the community continues to enforce the higher regulatory standards,
- Credit is provided for keeping the channels and retention basins of a community’s drainage system clear of debris in order to maintain its flood carrying and storage capacity.

The Town of Narragansett currently has 1,575 policies in effect with a total coverage of \$402,589,600. The Town has thirty-three repetitive loss properties which are located in Breakwater Village, Jerusalem, Boston Neck Road, Rio Vista, Ocean Road, Bonnet Shores, Galilee, and Great Island. The Flood Insurance Rate Map was last updated for Narragansett on October 19, 2010.

The State of Rhode Island has adopted the International Residential Code 2010 and the International Building Code 2010 to further safeguard new structures and additions in flood prone and high wind areas south of Bridgetown Road. Sheer wall blocking will prevent damage in coastal areas.

Narragansett has identified 3 Red Cross approved emergency mass care facilities throughout the town. The American Red Cross (ARC) requires 40 square feet of usable space per person in each mass care facility. According to FEMA, in the event of a natural disaster that requires mass care facilities, twenty percent of an evacuated population will seek public mass care facilities. The mass care facilities are free of flood risk and the total mass care facility capacity is 1050 for short term accommodations.

The ARC mass care facilities in Narragansett are:

1. Narragansett High School- Capacity of 500- Primary
245 South Pier Road
Narragansett, RI 02882
2. Pier Middle School- Capacity of 350-Secondary
235 South Pier Road
Narragansett, RI 02882
3. Narragansett Elementary School- Capacity of 200- Overflow
55 South Munford Road
Narragansett, RI 02882

Narragansett looks for opportunities to improve other essential services and critical facilities. In addition to the three schools, critical facilities include the Town Hall, Department of Public Works garage, Fire Station #2 and Fire Station #3, the Scarborough Wastewater Treatment Facility, and the Regional Wastewater Treatment Facility. Many of these are the basic “centers of government activity” that host critical response efforts during and after disaster events.

The town recently completed a mitigation project from damage caused by the 2010 March flooding. The storm took out the earthen embankment at Sprague Pond (because the old small stone outfall culvert failed), and the Town replaced the outfall culvert with a larger sealed pre-cast concrete unit that is designed to handle storm flows.

The town has a number of Emergency Preparedness measures in place including an automated mass notification system that was implemented in 2009. The Fire Department offers outreach programs, such as CPR/AED training and the Fire Marshal will visit the schools when requested. The Fire Department also hosts open houses to encourage participation from the general public.

3.0 ASSESSING VULNERABILITY

Vulnerability indicates what is likely to be damaged by the identified hazards and how severe that damage could be. This section focuses on Narragansett vulnerable areas in regards to the identified hazards, what is at risk in these areas (structures, population, natural resources) and what the impacts will be (loss of life, environmental damage, inconvenience to residents). The Risk Assessment Matrix (Table 11)

summarizes the major vulnerable areas in Narragansett. This section also takes a look at Narragansett's population at risk, the potential economic losses and future development trends.

The Maguire Group worked with the Town of Narragansett to create maps for the Town of Narragansett 2011 Hazard Mitigation Plan update. The maps portray the community facilities, population by census block, transportation networks, water supply and sewer infrastructure, flood zones, areas vulnerable to flooding, and anticipated peak wind speeds during a hurricane. The maps can be found prior to the appendices.

Vulnerability – Severe Weather

Narragansett rates its vulnerability to severe weather as medium. Due to the size and geography of the town there are no areas in Narragansett that are more susceptible to severe weather than others. In general winter storms, severe thunder storms, nor'easters and ice storms have a similar effect throughout the entire town.

Vulnerability – Hurricanes

Narragansett rates its vulnerability to hurricanes as High. Due to Narragansett's geography, hurricane storm surge poses a tremendous threat on south and east facing shores. Wave run up causes coastal flooding to commence as much as 6 hours before the eye comes ashore with the most significant surge occurring within one hour of landfall. Heavy rains from hurricanes can cause flooding in the low lying areas in Narragansett, and hurricane winds can cause damage to property and infrastructure throughout the town and Several critical facilities are also located within vulnerable areas a sewage treatment facility, which services the southern part of town and all of Galilee, is located within the flood zone just south of Scarborough Beach and subject to both flood, storm surge and wind damage.

The Roger Wheeler State Beach pavilion is a fairly new structure located in the V zone. Although the beach pavilion is fairly well protected by the Harbor of Refuge breakwaters, it was still required to conform to NFIP standards. It has been built high enough to survive a 100-year flood. The fire/police station, located at 40 Caswell Street, is located in the floodplain, but has been elevated above the 100-year flood level. Although the structure itself is elevated, access roads for the fire/police station may flood during a storm. There are no medical/institutional facilities located within the hurricane surge areas.

Narragansett's exposed shoreline not only makes the town vulnerable to coastal flooding and erosion from hurricanes and nor'easters, but also to relative sea level rise which has been historically approximately 25 centimeters per 100 years, however, most climate change models show that this will accelerate. Sea level rise may displace beaches landward, drown coastal marshes and increase flooding problems." In addition, sea level rise will probably increase the frequency of sand over wash. Any amount of future sea level rise will result in an increased rate of coastal erosion as waves will break higher on bluffs and dunes along the open shoreline for any given storm intensity.

According to the HAZUS model run for a hurricane scenario, it is anticipated that 8,462 buildings will experience at least moderate damage. This is 87% of the building stock in the Town of Narragansett. There are an estimated 3,686 buildings that will be completely destroyed. Table 9 displays the data for Damaged Buildings by Occupancy.

Table 9 – Expected Building Damage by Occupancy*

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	1	2.25	4	10.68	11	27.31	16	41.18	7	18.58
Commercial	13	3.67	27	7.44	86	23.71	221	61.11	15	4.08
Education	0	4.36	1	7.79	2	24.41	5	62.22	0	1.22
Government	0	4.07	1	6.26	3	20.91	8	67.73	0	1.03
Industrial	4	4.00	6	6.35	21	21.24	64	64.21	4	4.20
Religion	1	3.63	2	9.98	5	28.41	10	54.26	1	3.73
Residential	169	1.85	1,005	10.97	1,997	21.81	2,327	25.41	3,659	39.95
Total	189		1,045		2,125		2,652		3,686	

*Table as found in HAZUS

Vulnerability – Heat Waves

Narragansett rates its vulnerability to Heat Waves as low. Extreme heat can cause roads to buckle and crumble. From the excessive use of A/C units, the power grid is put into jeopardy causing wide spread power outages. This puts critical infrastructure at risk of failure such as traffic controls, telecommunications and police and medical services. Damaged roadways along with sagging and downed power lines will further restrict mobility.

Residents are also vulnerable to dehydration which can lead to injury or even death in the event of a heat wave. The body cannot easily compensate with overexposure to heat. Heat-related illnesses include fatigue, dehydration, heat exhaustion and heat stroke. In a normal year, about 175 Americans die from the summer heat.¹⁰

Vulnerability – Flooding and Dam Failure

Narragansett rates its vulnerability to flooding and dam failure as low. Floodplains in Narragansett include “A,” “V” and “X” zones. A zones are areas that would be inundated by the 100-year flood. V zones are velocity zones that are subject to breaking wave action where waves greater than 2.9 feet are forecasted during a 100-year flood or storm surge.⁵ X zones are areas that would be inundated by the 500-year flood. About 40 percent of the town is located in flood zones (counting the 500-year flood areas). These areas will suffer most as indicated by projected hurricane direction, forward speed, landfall points and high astronomical tides.

As seen in Table 10, FEMA estimated that the value of property insured by the NFIP in Narragansett is \$402,589,600.

Table 10: Summary of National Flood Insurance Program Activity in Narragansett

NFIP Information	Value
NFIP Policies in Effect	1,575

¹⁰ National Weather Service "Heat Wave: A Major Summer Killer" *NOAA's National Weather Service*, 6 Jan. 2005.

Total Premium	\$1,431,908
Number of Policies in A* Zone	851
Number of Policies in V* Zone	35
Total Coverage	\$402,589,600
Total Claims Made Since 1978	284
Total Claims Paid Since 1978	\$2,599,864
Number of Repetitive Losses	33

Table 10 – NFIP Information for the Town of Narragansett as of July 14, 2011

* V-zone refers to the velocity zone, where waves greater than 2.9 feet are feasible during a 100-year flood. A-zone refers to other areas within the 100-year flood zone with less than 2.9-foot waves (FEMA, 1997).

The most significant threat posed by floods to the natural environment is the potential damage to fish and wildlife habitat. Channel alteration may affect wetlands and habitats in frequently flooded areas. The runoff associated with development and increased impervious surfaces has increased the occurrence of flooding. Runoff, bank erosion, sedimentation can alter the aquatic ecosystem and be potentially devastating to the fish habitat. While building in a floodplain may damage ecosystems, a flood induced by encroachment on the floodplain may further this damage by introducing toxins, debris, and significant amounts of sediment to the system. The flood's flow velocity may further increase losses to the ecosystem by removing riparian vegetation and salmon spawning areas.

Vulnerability – Tornadoes

Narragansett rates its vulnerability to Tornadoes as high. Though tornadoes have been rare in Narragansett, there is a high probability that tornadoes would cause significant damage to the built environment. All above-ground buildings, infrastructure, and critical facilities are at risk to damage and destruction by tornadoes. Due to the erratic movement of tornadoes, destruction often appears random.

There is not a lot of data to show how tornadoes effect the natural environment. Vegetation and soils can get stirred up and redistributed which can kill plants and organisms living in the soil.

Transportation systems are highly vulnerable to tornadoes due to debris and cars on the road during a possible event. Transportation closures due to tornadoes may limit businesses abilities to operate normally. Businesses may be forced to close temporarily due to lack of power or access to roads. The disruption of delivery would also have negative impacts on the local economy. Small businesses are particularly vulnerable to temporary closures and property damage.

All people are equally vulnerable to tornadoes in Narragansett. Transportation and road closures could isolate some neighborhoods. Services and supplies may be limited in the aftermath of a tornado.

The presence of valuable buildings, infrastructure, natural environment and people make the Town vulnerable to Tornadoes. The short warning time for tornadoes also increases the City's vulnerability to tornadoes.

Vulnerability - Drought

Narragansett rates its vulnerability to Droughts as low. Droughts have no significant impact on man-made structures. Lawns, gardens, and other human-manipulated landscapes and vegetation such as golf courses are vulnerable to droughts. Drought will impact all populations in Narragansett. Specific businesses that require larger portions of water to run their business (carwashes, golf courses, etc.) will be especially vulnerable if they do not have mitigation strategies in place to withstand the shortage. Reduction of available water in reservoirs intensifies the debate over water allocation among agricultural irrigators, municipal water authorities, environmental agencies, and industrial users.

Drought may reduce stream flows, which will impact aquatic life and ecosystems that are dependent on the stream. Low stream flows will increase water temperatures affecting the migration and reproduction habits of wildlife. A drought may also lead to insufficient recharge of aquifers, creating water shortages. Decreased precipitation will increase the likelihood of wildfires, as dry trees and brush have an increased risk of burning.

Vulnerability – Earthquakes

Narragansett rates its vulnerability to earthquakes as low. Most of the town is built on Narragansett Pier granite, which is a very solid substrate. Narragansett enforces the state building code, which has been in existence since 1977 and has standards for new construction and major reconstruction of buildings so that they are built to withstand an earthquake that registers 3.0 on the Richter scale. In general, buildings that are most at risk from earthquakes are old masonry buildings and large structures, such as the town hall, buildings on the University of Rhode Island's Bay Campus, the high school and the elementary school.

Population at Risk

According to FEMA, in the event of a natural disaster that requires mass care facilities, twenty percent of an evacuated population will seek public mass care facilities. Currently Narragansett is capable of providing mass care for approximately 1050 people in the event of a natural disaster.

According to the 2010 U.S. Census Narragansett has a population of 15,868 people. This could result in a deficit of mass care spaces for the town.



Narragansett has established evacuation routes and has posted evacuation signs, however, is in the process of re-designating some of these routes based on new flood modeling that will cut off part of the Town from evacuation. In addition, if the natural disaster is localized, other shelters in surrounding towns will be available.

It is noted that Narragansett experienced a 0.03 percent population count decrease from 2000 to 2010. This plan recognizes that residential development continues to occur and has proposed actions that not only address the current needs of the town in the event of a natural disaster but also the future needs of the town. Though the population decreased, it is important to note that Narragansett has a seasonal population. Weekend population during the summer months can exceed 35,000 and during the University of Rhode Island calendar year it is estimated that the town has a population of 18,000 – 20,000. Neither of those numbers are accounted for in the census data.

Potential Losses to the Local Economy

Since property taxes account for 86.5 percent of Narragansett's revenues, it is imperative that the community and its residents take precautions to protect their investments. According to Narragansett's Finance Department, the current budget for Narragansett is \$50.1 million per year and the local Finance Director reports that approximately \$43.8 million comes from all taxes with \$42.3 million being from the real estate taxes.

About 6.5 percent of the taxes collected in Narragansett come from commercial and industrial properties. As seen in Table 10, FEMA estimated that the value of property insured by the NFIP in Narragansett is \$402,589,600.

Future Development Trends

The Town of Narragansett has been one of the fastest growing communities in Rhode Island over the past four decades. Since 1960 when only 3,444 people resided in Narragansett, the Town's population has grown by nearly 500% peaking at 16,361 in year 2000. However, the past decade between 2000 and 2010 showed a 3% decline in population from 16,361 to 15,868. This figure does not provide the entire picture. As noted earlier, the Town and region are very susceptible to seasonal fluctuations in population caused by summer tourists and winter college students. These alternating populations fill many of the 2,500+ rental properties located in Narragansett. Depending on the fluctuations in vacancy rates, it is estimated that these populations, which are not captured well in the US Census count account for an additional 2,500 – 7,500 people residing in Narragansett on any given day.

Statistical growth projections have been provided by the RI Statewide Planning Program in Technical Paper Number 154 entitled "Rhode Island Population Projections: State, County and Municipal 2000 – 2030" This report, based on the 2000 Census figures projects Narragansett's population to increase to 19,028 in year 2020 and 20,256 by year 2030. In light of the downturn between 2000 and 2010 this figure may be considered to be a high estimate. Town staff concurs that the US Census figures may not reach that high in 2030, but maintains its assertion that the Town's average daily population likely exceeds this number already.

Development of new residential structures has also trended downward in the past decade. In the decade of the 90's Narragansett averaged about 80 new dwelling units permitted each year. Since 2000 that average continued through 2003. From 2004 through 2010 new housing starts fell off dramatically, averaging 24 units per year over that time span. This statistic is indicative of circumstances statewide and largely attributable to the economic downturn that dominated the latter half of the decade.

Looking to the future, the Town is initiating an update of its townwide Comprehensive Plan in 2012. As part of that study the economic condition of the Town will be assessed and policies will be considered to foster healthy commercial and industrial growth along with new housing starts for the next 20 years. At this time, it is anticipated that the current austerity will continue for 2-5 years. Housing starts are expected to remain stable at about 20-25 per year for the near future term of 3-5 years. If past trends are replicated, it can be expected that the economy will rebound into a cycle of significant growth.

However, it is uncertain if a resurgence will occur in the 10 year time frame of this Plan. Development in areas prone to hazardous conditions can be expected to continue at a similar pace as today due to the attraction they offer to waterfront and waterview housing. The Town's environmental overlay regulations provide regulatory protection of the sensitive natural resources such as flood plains and wetlands. Nonetheless, it is impossible to completely restrict development in these areas where property owners are willing to expend large sums of money to achieve compliance with the performance criteria of these regulations.

Climate Change

As a result of extensive research done by the Intergovernmental Panel on Climate Change¹¹, we know that Rhode Island's climate is changing, and the impacts of these projected changes will be far reaching. Although our state is working to significantly reduce its contributions to climate change, some changes cannot (or will not) be prevented. For the Town of Narragansett expected changes include:

- Hotter, drier summers
- Wetter winters with increasing precipitation and rain intensity
- Increases in weather extremes
- Secondary hazards include increased chance of wildland/urban interface fires, heat waves, insect infestation, drought, potable water shortages, flooding, erosion and landslides.
- Sea level rise which increases tidal events during storms

The Narrow River Sample Area Management Plan, (SAMP) is part of the Rhode Island Coastal Resources Management Council's (CRMC), ongoing responsibility under the Coastal Zone Management Act (CZMA). It includes the Towns of North Kingston, South Kingston, and Narragansett. The CRMC is empowered by Rhode Island state statute 46-23-15 to administer land and water use regulations as necessary to fulfill their responsibilities under the Federal CZMA (16 U.S.C. §1451). The Narrow River Special Area Management plan describes the present status of the river, characterizes its watershed, identifies sources of pollution, and recommends specific actions to restore, protect and preserve this highly regarded natural resource.

According to this plan:

¹¹ IPCC - Intergovernmental Panel on Climate Change.

Sea level is presently rising at a rate of 27 cm per century as measured at the Newport tide gauge. The present rate of rise is matched by the upward growth of salt marsh peat so that the high marsh surface is level with spring high water. However, the present rate of sea level rise is raising the ground water table in the glacial river sediment along the river. This elevated water table adds to the problem of failing septic systems. Future sea-level rise will gradually inundate, from south to north, the gently sloping glacial delta plain particularly in the Middlebridge Road area of South Kingstown. Accelerated sea level rise due to global warming will, of course, hasten this process.

In the northeastern United States, signs of our planet's changing climate have become increasingly apparent. Over the past 30 years, average winter temperatures in the region have risen 3.8 degrees Fahrenheit (Union of Concerned Scientists, 2006). The Northeast has experienced the largest increase in extreme precipitation events in the country. New England as a whole has experienced a 61 percent increase in such storm events over the past 59 years, while Rhode Island in particular has witnessed an 88 percent rise over the same period-¹² Additionally, data from the Newport tide gauge (1930-2006) suggests a relative rate of sea level rise equal to 10.2 inches (\pm 0.75 inches) over the last century in Rhode Island, with the last 19 years (1989-2007) showing an even higher average rate of sea level rise: approximately 0.157 inches per year (National Oceanic and Atmospheric Administration.¹³ If this linear trend continues, Newport's sea level in 2100 will be 15 inches higher than today. However, most model predictions are non-linear; these models anticipate sea levels to be approximately 1.6 to 4.6 feet higher by 2100. Higher sea levels will mean that coastal flood zones will move inland, encroaching on areas that currently are not in high risk flood zones.

Scientists expect the Northeast climate to warm approximately 0.5°F every ten years over the next several decades. This rate is more than three times faster than the warming experienced during the twentieth century. In Rhode Island, scientists project that average annual temperatures will be 1.9°F higher by the 2020s when compared with the 1970-1999 average and 2.9°F higher by the 2040s. Changes in total precipitation are not projected to be significant over that time period; however, patterns of precipitation will change. Winters will bring more rain and less snow.

These projections are based on calculations that take into account human contributions to the accumulation of greenhouse gasses. Being man-made, these projections could be tempered, should efforts be made at reducing greenhouse contributions. While such efforts could slow warming, the impacts would continue for some time. The Town of Narragansett will take a closer look into the impacts of Climate Change on the Town in future updates when there is more data available.

3.1 RISK ASSESSMENT MATRIX – VULNERABLE AREAS

The LHMC has met regularly to discuss the town's vulnerability to natural hazards, select projects and develop actions that will help to meet Narragansett's mitigation goals.

¹² Madsen and Figdor, 2007.

¹³ National Oceanic and Atmospheric Administration, 2007

Organization of projects and actions was accomplished by thoroughly reviewing the hazards, identifying areas, essential services, critical facilities and infrastructure in Narragansett which are at risk and identifying present dangerous situations to Narragansett's population which are susceptible to costly damage. The result of these efforts was the Risk Assessment Matrix (Table 11) that follows. Vulnerable areas have been prioritized and ordered as such.

Table 11 – Risk Assessment Matrix

	Vulnerable Area (in order of priority)	Location	Ownership	Natural Hazard	Primary Problem/Effect	Mitigation Objective	Risk H – Historical P – Potential
1	All-Hazards Mitigation of Property and Critical Roads	Flood zones and South Shore beach areas Jerusalem, Roger W. Wheeler State Beach, Scarborough State Beach, Salty Brine State Beach)	Public and Private Structures and Beaches	Erosion and Flooding, Severe Weather, Hurricanes, Tornadoes, Conflagration, Earthquake, Heat Waves, Drought	- Property loss - Public safety - Economic loss -Evacuation hindered	- Protection of property and public safety - Prevention of economic loss – Decrease public and private costs of cleanup after disaster	H 1938 severe damage, 1944 high waters, 1954 water 20 feet above mean sea level
2	Beach Erosion	Narragansett Town Beach, Bonnet Shores, Jerusalem, Roger W. Wheeler State Beach, Scarborough State Beach, Salty Brine State Beach	Public and Private	Erosion	Threat to long-term ability of barriers to provide storm protection for the ponds and backshores	Increased integrity of barrier to provide protection of backshore	H 1928, 1944, 1954, 1978, 1991, every nor'easter
3	Ocean Road Seawall and Route 1A (Ocean Road)	Ocean Road (1A)	State	Erosion, Flooding, Storm Surge	- Road could be washed out during a storm -Sewer and water mains could be damaged	-Protection of property, businesses and onlookers during storm -Protection of public utilities	H 1938, 1954 damaged
4	Sanitary Sewer/Water Lines and Mains	Col. John Gardner Road, Bonnet Shores, Sprague Bridge, Mettatuxet area, Bridgetown Road and Pettaquamscutt area, Boston Neck Road, Ocean Road, Stanton Avenue, Woodridge Road, River Drive, Wayland Trail,	South Kingstown and Narragansett United Water of Rhode Island	Flooding, Erosion, Earthquakes, Tornadoes, Severe Weather	-During flood events, septic systems could become exposed and fail - Loss of sewer service for these areas - Gravity sewers and force mains located in flood prone areas - Water lines located in flood prone areas that may threaten integrity of	- Limits health and pollution risks - No interruption of essential services	P

	Vulnerable Area (in order of priority)	Location	Ownership	Natural Hazard	Primary Problem/Effect	Mitigation Objective	Risk H – Historical P – Potential
		Harbour Island area, Point Judith, Galilee, Jerusalem, Great Island			pipes - Safety and health issues - Potential pollution to adjacent waterways - Loss of water service to affected area		
5	Narragansett Beach and Pavilion, Bonnet Shores Beach and Pavilion	Ocean Road (1A) Bonnet Point Road	Town Private	Hurricanes, Severe Weather, Erosion, Wind and Flood Damage	- Threatens stability of beach structures - Damage to beach facilities - Damage to parking lot - Decrease in tourism	- Maintenance of beach profile - Protection of a major resource for tourism	H 1938, 1944, 1954 Wind and Flood Damage
6	Great Island Bridge Lacy Bridge Middlebridge Bridge	Great Island Road Timberbridge Bridgetown Road Middlebridge along Narrow River	State State Town (South Kingstown and Narragansett)	Flooding, Earthquakes, Tornadoes, Severe Weather, Hurricanes Flooding wave action	- Cut off access to Great Island (350 homes) - Access to Route 108 cut off, loss of access, loss of water supply - Damage to gas supply line - Interruption of essential services - Loss of bridge and loss of sewer and water service to South Kingstown and Narragansett respectively	- Maintain water supply - Limit risk to public health - Navigation transportation access Same for all three bridges.	P P H 1938, 1954 Completely washed out
7	Point Judith Pond Shoreline	Point Judith Pond	Various	Flooding wave action	-Property damage to docks (800), marinas, small boats, trees	- Less property loss	H 1991 extensive structural damage
8	Tree Damage	Town-wide	Public and private	Fire, wind/ice storms, nor'easters	- Excessive tree damage causes downed utility lines	- Maintaining constant power during events of high wind	H 1991 Extensive

	Vulnerable Area (in order of priority)	Location	Ownership	Natural Hazard	Primary Problem/Effect	Mitigation Objective	Risk H – Historical P – Potential
					<ul style="list-style-type: none"> - Lack of power and communication - Road blockage - Safety issue (downed lines) - Property damage - Disposal of debris after major events 	<ul style="list-style-type: none"> - Increased safety - Lower costs/less time for recovery - Decrease in transportation and disposal problems 	structural damage
9	Galilee	South Shore	State	Hurricanes, nor'easters, flooding	<ul style="list-style-type: none"> - Dock damage from waves - Business district at risk 	<ul style="list-style-type: none"> - Safeguard businesses - Reduce risk of damage from disturbed petroleum tanks 	H 1938 Fishing fleet and buildings were destroyed 1954 Roads buried with wreckage, boats washed onto parking lots
10	Sewage Treatment Facility	South End (Scarborough) Serves the neighborhood south of Foddering Farm and Windemere Road	Town	Flooding	<ul style="list-style-type: none"> - Facility becomes inoperable – overflow into Block Island Sound - Closing fisheries and tourism - Odor problem/health/beach closure - Evacuation 	<ul style="list-style-type: none"> - Cleaner water - No interruption of service 	P
11	Sewer Pumping Stations	Wolfe Road Allagash Trail Sprague Bridge Mettatuxet Galilee Stanton Avenue	Town	Flooding	<ul style="list-style-type: none"> - Loss of sewer service for affected areas - Potential pollution to adjacent waterways - Pump stations located in flood prone areas 	Limit health, safety, and pollution risks	P

4.0 MITIGATION ACTIONS

4.1 MITIGATION ACTIVITIES

Municipal officials in Narragansett assessed the risks to the town and developed mitigation actions that address a mix of structural initiatives (building code enforcement, repair and retrofit of existing structures, and removal of vulnerable structures) and nonstructural initiatives (educational programs, preventing construction in high-hazard areas, enforcing regulations) to minimize the effect of future hazards. By creating this strategy and incorporating it into the town's comprehensive plan and the site plan review process, Narragansett has established an ongoing process that will make hazard mitigation a routine part of municipal government.

In completing the risk and vulnerability analysis, the LHMC considered projects and actions that would reduce Narragansett's vulnerability to the identified hazards. The Risk Assessment Matrix is the basis for the mitigation actions presented in Section 4.2. The LHMC considered the goals of this plan (section 1.3, page 10) and prioritized the matrix and the associated actions based on historical damage, safety of the population, property protection, and consistency with town-wide goals and objectives. Objectives were aligned to public health risks, evacuation and mass care considerations, disruption of essential services, and potential economic losses to Narragansett.

Once the mitigation actions were identified, the LHMC members were provided with several sets of decision-making tools, including FEMA's recommended criteria, STAPLE/E (which considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits).

- Social: Does the measure treat people fairly?
- Technical: Will it work? (Does it solve the problem? Is it feasible?)
- Administrative: Is there capacity to implement and manage the project?
- Political: Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support the project?
- Legal: Does your organization have the authority to implement? Is it legal? Are there liability implications?
- Economic: Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?
- Environmental: Does it comply with environmental regulations or have adverse environmental impacts?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining project priority (the 'economic' factor of STAPLE/E). Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does action protect lives?
- Does action address hazards or areas with the highest risk?
- Does action protect critical facilities, infrastructure or community assets?

- Does action meet multiple objectives (Multiple Objective Management)?

The LHMC used a cost-benefit review in the prioritization process to maximize benefits. The LHMC prioritized the vulnerable areas in order of vulnerability which indicated that more damage could be sustained to these areas thus more costs could be incurred by the Town in damages and repairs. The mitigation actions identified would maximize the use of funding and reduce loss of people and property.

The LHMC determined that the identified objectives could be met by considering actions aligned to the following:

- Planning and Regulations
- Property Protection (including acquisition and elevation), Structural Projects, Maintenance, and Repair
- Public Information and Outreach, Incentive Programs
- Protection of Essential Services (including critical facilities)
- Post Disaster Opportunities

This committee has worked to set goals and objectives that are bound by a time frame and are compatible and consistent with state hazard mitigation goals. Upon submittal of this plan to RIEMA, the State Hazard Mitigation Committee (SHMC) is expected to review and approve these goals and objectives to ensure consistency with statewide goals and objectives. The time frames used for these strategies are as follows:

- Short Term = 0 to 6 Months
- Medium Term = 6 to 18 Months
- Long Term = 18 Months to 5 Years

The following actions use the Risk Assessment Matrix (Table 12) to identify areas at risk, offer mitigation strategies and consider benefits. Current status is noted since adoption of the previous and if action is “new” this is indicated. Each action offers a discussion of the project and if applicable, includes the options considered. Multiple actions associated with a vulnerable area reflect town priorities and are simply prioritized high, medium, or low. If known, the actions include cost estimations and assign responsible parties to lead the efforts to complete the action.

Other relevant departments/agencies that can offer support to the project are also listed. Finally, possible finance options are offered.

4.2 ACTION PLAN

Vulnerable Area #1

All-Hazards Mitigation of Property and Critical Roads

Action 1: Planning and Regulations - Open Space Acquisitions

One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. Doing so can also help the town receive a better CRS rating. Additional CRS credit is given for parcels that have deed restrictions. The town will try to acquire open space in flood zones through the Land Conservancy Trust, the Bonnet Shores Land Trust or Narrow River Land Trust. Special consideration should be given to

erosion-prone areas or floodplains where there is a possibility of obtaining a bigger block of land (several adjoining lots) in the flood zone rather than a few separate smaller parcels. The LHMC (point of contact will be the Development Director) will pursue land for acquisition in flood-prone areas that would provide public access to coastal waters or that have experienced recurring flood damage.

- Lead: Narragansett Land Conservancy Trust
- Other Response Parties: Narrow River Land Trust, building inspector, town council, FEMA and RIEMA
- Financing Options: FEMA grants, land acquisition bonds (state and municipal), land bank, and RI DEM
- Cost: Variable
- Time frame: Long-term

Current Status: The Town has acquired several properties in flood prone areas but all previous to the 2005 plan update but after 1990 when the Narragansett Land Trust was established. The LHMC has reworked this action. The LHMC does not want to specifically develop a list of priority lots but will pursue land in the flood-prone areas. The Town already has open space areas this would only be expanded with acquisition of flood-prone areas. Most of the current open space is located within flood-prone areas.

Action 2: Planning and Regulations - Multi-Hazard Zoning Overlay

The planning department will amend the existing flood zone overlay to incorporate multiple hazards and include standards/restrictions and best management practices for land in natural hazard-prone areas.

- Lead: Town Planner
- Other Responsible Parties: Town Engineer
- Financing Options: Town Budget
- Cost: Staff Time
- Time frame: Long-term

Current Status: The Town will not incorporate multiple hazards into the flood overlay. This action will be deleted. Map 4 shows the flood zones.

Action 3: Planning and Regulations - Hazard Mitigation Monitoring

The building inspector will monitor construction conformance with RI CRMC setbacks and buffer regulations. The building inspector will continue to monitor and enforce the state building code for construction in flood zone areas. The building inspector will disclose information on natural hazards (especially floodplain locations) to potential homeowners.

- Lead: Town Planner
- Other Responsible parties: Zoning board, planning board, Narragansett Land Trust and conservation commission
- Financing options: town budget
- Cost: staff time
- Time frame: long-term

Current Status: The building inspector has incorporated this as a standard protocol and this is no longer an action for this plan. It is consistently ongoing and will be deleted as a mitigation action.

Action 4: Planning and Regulations - Interdepartment Staff Meetings

Hazard mitigation planning should be incorporated into staff meetings with municipal department heads. Currently, the LHMC meets to discuss all new projects under review by municipal officials that are proposed in hazard areas. LHMC meetings could address preferred construction practices, mitigation opportunities and hazard disclosure. The LHMC will develop a procedure involving officials with skills in hazard analysis/evaluation and hazard mitigation for coordinated review of proposed projects within hazard areas. The LHMC will use the maps in this document during meetings and use the town's databases and GIS system for analysis of high hazard areas.

- Lead: LHMC
- Other responsible parties: planning board, conservation commission and building official
- Financing options: town budget
- Cost: staff time
- Time frame: short-term

Current Status: The Town has incorporated hazard mitigation planning into staff meetings with municipal department heads and the LHMC meets to discuss all new projects under review by municipal officials that are proposed in hazard areas. This occurs on an ongoing basis and the LHMC would like to remove this part of the action. The remainder of the action will be done on an ad hoc basis as needed.

Action 5: Public Information, Outreach and Incentive Program

Property preservation should be encouraged through floodproofing techniques and retrofitting for wind damage. Homeowners and contractors should be educated on appropriate methods for landscaping to reduce erosion and other damage and on RI CRMC's erosion rates and setbacks. Narragansett will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The town should use FEMA publications or develop a town-specific list of appropriate techniques for homeowner self-inspection and suggest subsequent implementation of mitigation activities. The Town will also utilize this opportunity to produce public information on drought and the impacts it can have to the Town of Narragansett and its residents.

- Lead: Building Official
- Other Responsible Parties: RI CRMC, Town Planner, Fire Chief (local EMA director) and Institute for Business and Home Safety
- Financing Options: Town Budget
- Cost: Staff Time
- Time Frame: Short-term

Current Status: The LHMC has reworded this action to change "neighborhood preservation" to "property preservation." Code compliance is enforced in the Town to address potential hazards. The Town will continue to educate the contractors and homeowners on the risks of living in hazard-prone areas and will strengthen and expand the appropriate development standards for the overlay districts. The LHMC also added a public information campaign on drought that will be made available to residents.

Action 6: Public Information, Outreach and Incentive Program - Tourist Evacuation and Shelter

Make information on evacuation routes and shelter locations available at rental properties and hotels located in the flood zones and near potential hurricane inundation areas. Use the local media to help deliver information on evacuation routes and shelters. Coordinate with the Rhode Island Department of

Transportation (RI DOT) and the U.S. Army Corps of Engineers to post evacuation signs along the locally established evacuation routes. As RI DOT approves statewide essential roads, the fire chief, who serves as local EMA Director, and the public works director will work with the state to ensure consistency in both the statewide routes and the locally established routes. Even though evacuation is not mandatory, early evacuation for Jerusalem, Great Island, Galilee, Harbor Island, Boston Neck Road (south of Sprague Bridge and north of Kingstown Road) and Bonnet Shores will be strongly encouraged by municipal officials. RI DEM will educate campers on safety precautions for multiple hazards.

- Lead: Fire Chief (local EMA director)
- Other Responsible Parties: Public Works, Narragansett Chamber of Commerce and South County Tourism Council, RI DEM Division of Parks and Recreation
- Financing Options: Town Budget
- Cost: \$200 and staff time
- Time Frame: Short-term

Current Status: The Town has posted the evacuation signs and has a plan in place with pre-planned traffic control points that were established in conjunction with the Rhode Island State Police. The shelter signs on Boston Neck Road need to be removed to keep the signage consistent with the Town's evacuation planning. The Town needs to work with North Kingstown and South Kingstown to create memorandums of understanding for sheltering. The remainder of this action has not been accomplished due to funding and staff time but it is an ongoing project.

Action 7: Emergency Services – Evacuation and Sheltering

The Town of Narragansett needs to establish evacuation routes that do not bring residents and tourists through potentially flooded areas. The Town needs to establish memorandums of understanding with North Kingstown and South Kingstown for the sheltering of Narragansett resident and tourists during a potential evacuation. The Town needs to move evacuation signs to illustrate the new routes. This will also include keeping an updated list of heating and cooling centers for extreme weather events.

- Lead: Fire Chief (local EMA director)
- Other responsible parties: Police Department, Public Works, RIEMA, and American Red Cross
- Financing options: town budget
- Cost: staff time plus necessary materials
- Time frame: short-term

Current Status: This is a new mitigation action for the Town's hazard mitigation plan.

Action 8: Emergency Services - Additional Shelters

The current American Red Cross approved shelter capacity for Narragansett is about 135 people, and this shelter is near a hurricane evacuation area that may be cut off from roads during a strong storm. The fire chief (local EMA director) needs to work with representatives from the Rhode Island chapter of American Red Cross to establish additional shelters (preferably using large facilities such as the University of Rhode Island in Kingston, RI) that would provide the recommended 895 additional shelter spaces for a severe hurricane.

- Lead: fire chief (local EMA director)
- Other responsible parties: American Red Cross
- Financing options: town budget
- Cost: staff time plus necessary materials

- *Time frame: short-term*

Current Status: The LHMC has deleted this action. The Town added shelter capacity for over 900 more people since the mitigation action was written. This action is now obsolete.

Action 9: Emergency Services - Tide Gauges

The National Weather Service (NWS) will provide the town with two staff gauges. Markings will run from 0.0 feet to 12 feet. Narragansett will mount these staff gauges near Narragansett Pier and in Galilee, in a location accessible and readable from an automobile. Narragansett will set these based on local bench mark or NGVD markers for reference. The NWS will return to survey the locations to establish flood elevations and will provide Narragansett with its findings. In an actual storm event, Narragansett will call the NWS with their tide readings to assist the NWS in determining the threat of coastal flooding given other tide gauge readings on the bay, including Newport Harbor and Fox Point in Providence. Local police could use a staff gauge to buy more lead-time for evacuation.

- *Lead: NWS (Tel: 800 243-1686)*
- *Other Responsible Parties: fire chief (local EMA director), police department and town engineer*
- *Financing options: NWS*
- *Cost: no cost*
- *Time frame: short-term*

Current Status: The LHMC has decided to delete this action because there is no value to the tide gauges for public safety response during an event or mitigation prior to an event.

Action 10: Emergency Services - Police/Fire Station

Although the fire/police station is located in a floodplain, it meets floodplain building regulations and is not the designated emergency operations center for the town. However, special procedures will be put in place so that during a disaster vehicles and personnel can have easy access/egress.

- *Lead: fire chief (local EMA director)*
- *Other responsible parties: public works department and RIEMA*
- *Financing options: RIEMA and FEMA*
- *Cost: staff time*
- *Time frame: short-term*

Current Status: The LHMC Committee has decided to delete this action item. The building is not in a flood zone as determined by a flood elevation certificate prepared in 2006, but the main access road (Caswell Street) is prone to flooding, however access is through Kingstown Road when Caswell Street is flooded. The Town has also secured a secondary emergency operations center if this building were to be unusable.

Action 11: Post-disaster Opportunities - Bring Structures up to Current Code

As required by the NFIP standards, after flooding or storm surge damage or a major renovation that totals more than 50 percent of a structure's market value, it is necessary to bring the structure up to current code. RI CRMC has specific requirements for rebuilding (for further information, check RI CRMP Section 180, Emergency Assents; and the Narrow River and Salt Pond Region Special Area Management Plan sections on storm hazards). Post-disaster situations provide great opportunities to acquire repetitive loss properties that have suffered damage from multiple flood events.

- *Lead: building inspector*
- *Other responsible parties: state floodplain manager and building code commissioner*
- *Financing options: RIEMA and FEMA*
- *Cost: variable*
- *Time frame: short-term following a disaster*

Current Status: This action will be deleted as it is not a specific action but is a statement of facts.

Action 12: Post-disaster Opportunities – Acquisition

The Town will work to acquire repetitive loss structures. The Town currently has 33 repetitive loss properties.

- Lead: Building Official
- Other responsible parties: Town Planner
- Financing options: FEMA grants, land acquisition bonds (state and municipal), land bank, and RI DEM
- Cost: Variable
- Time frame: Long-term

Current Status: This is a new mitigation action for the Town's hazard mitigation plan.

Action 13: Create a Zoning Enforcement Program to ensure post-construction compliance on the originally approved construction design to ensure all dwelling units are up to code.

- Lead: Building Official
- Other responsible parties: Zoning Board, Planning Board
- Financing options: Town Budget
- Cost: Staff time
- Time frame: Medium-term

Current Status: This is a new action for the hazard mitigation plan.

Action 14: Post-disaster Opportunities: Underground Utilities

The Town would like to study and implement a project to bury electrical wires and other suspended cables. The Town would like to take the above ground utilities and place them underground. This is not a project that is financially feasible at this time; however, it is a long-term goal especially if federal funding is available to implement the project. This would eliminate property damage and protect life safety from downed utility lines and protect from lightning storms. The Town would prioritize areas that are more susceptible to damage during a storm such as Route 1A Boston Neck Road and Ocean Road.

- Lead: Town Planning Department, National Grid
- Other responsible parties: Town Engineer
- Financing options: Federal Grants
- Cost: Unknown
- Time frame: Long Term

Current Status: This is a new mitigation action for the 2011 Hazard Mitigation Plan Update.

Vulnerable Area #2

Beach Erosion

Action 15: Planning and Regulations - Overwash Sand Removal

Develop a policy that allows for the removal of pavement, concrete and other debris from the overwash. Remove overwash only in the immediate vicinity of houses, garages and other structures as necessary to provide reasonable and safe entrance and use. However, according to RI CRMC, washover sand, where feasible, should be left on non-paved roads, driveways and parking lots, in order to allow the natural barrier rollover to continue and to maintain the higher elevation. For details, please refer to RI CRMC's Salt Pond Region Plan. The removed sand will be returned to the adjacent beach. Where this is not practicable, public works crews will place sand in a protected public location for later removal. This will need to be coordinated with the state for state roads, such as Route 1 next to the town beach.

- Lead: Public Works Department
- Other Responsible Parties: RI DOT
- Financing Options: Regular Maintenance Program (state and local), FEMA Public Assistance
- Cost: Variable
- Time Frame: Short-term

Current Status: This has not been accomplished. The Town will prioritize this as an action over the next twelve months.

Action 16: Property Protection, Structural Projects and Maintenance - Retrofit and Elevate

In the floodplain, elevate structures to the 100-year base flood elevation and set back damaged structures. Properties located in V zones are at higher risk and should be dealt with separately. Encourage maximum setbacks and relocation. While retrofitting for flood, light structural and non-structural projects can easily be done at the same time that could help protect a home from wind and earthquake shaking, providing a greater benefit at a lower cost. FEMA manuals are available on construction practices for non-residential structures.

- Lead: Building Official
- Other responsible parties: Town Planner, Zoning Board
- Financing options: FEMA grants
- Cost: Variable
- Time frame: Long term

Current Status: The Town currently encourages maximum setbacks and relocation. The Town has stricter policies within the flood zone by enforcing the State Code and the Local Floodplain Overlay Ordinance which has been in place since 1987. The policies have become stricter since October 2010. The Town will keep this mitigation action and will seek federal funds when available to assist property owners in low lying areas to retrofit their properties.

Action 17: Property Protection, Structural Projects and Maintenance - Beach and Dune Replenishment

Use dredge material from Point Judith (federal navigation channel) to enhance the dune system and re-nourish a beach in East Matunuck, Jerusalem and Town Beach. This procedure is most effective when used in conjunction with beach replenishment and regular maintenance on wide beaches (100 feet or more of beach in front of dunes). It is important to establish a long-term and stable funding source for this project. It may be possible to piggyback this project with the U.S. Army Corps of Engineers dredging projects, if the town can find a less expensive disposal site than the one Army Corps would have otherwise used. If the disposal site is less than a mile away from the dredging site, a booster pump will

not be needed, which will help reduce project costs. The town must work with the Army Corps and the RI CRMC to assure that permits are in place for dredge disposal.

- Lead: Director of Parks and Recreation
- Other responsible parties: Town Engineer
- Financing options: Town Budget, Army Corps, FEMA grants
- Cost: Variable
- Time frame: Medium-term

Current Status: The Town has hired Woods Hole Group (2011) to investigate beach replenishment options and the report is forthcoming in August 2011. The Town will look to take further action once the options are analyzed and funding is found to implement the project.

Vulnerable Area #3

Ocean Road Seawall and Route 1A (Ocean Road)

The LHMC added Route 1A to this Vulnerable Area.

Action 18: Planning and Regulations - Protect Onlookers During a Storm

The town will work with the governor's office to create a declaration to keep onlookers and the media off Ocean Road during storm events.

- Lead: fire chief (local EMA director)
- Other responsible parties: governor's office, local police department and state police
- Financing options: town budget
- Cost: staff time
- Time frame: short-term

Current Status: The LHMC will delete this as a mitigation action. The Town policy of the police department is to block off roads within the vicinity of the Seawall and Town Beach, however, stopping pedestrian traffic is always an issue. The Town works with the State Emergency Operations Center to request National Guard assets to assist in this problem.

Action 19: Property Protection, Structural Projects and Maintenance - Seawall

Stability of the seawall should be evaluated. Repairs and regular maintenance should be made when necessary to enable it to withstand a 20-to 50-year storm.

- Lead: RI DOT
- Other responsible parties: None
- Financing Options: RIEMA and U.S. Army Corps of Engineers
- Cost: \$15 million
- Time frame: Long-term

Current Status: The LHMC deleted the following: "The town will consider relocating (perhaps back to Boon Street, which runs parallel to Ocean Road) the main sewer line that runs underneath Ocean Road. The LHMC realizes this would be very costly, but, although not feasible now, it is worthwhile to document this in case future monies are available for such a project." This is not a feasible action item. The Town will work with RI Department of Transportation to continue to evaluate the stability of the seawall and ensure proper maintenance is addressed. The Town is concerned with the structural

integrity of the seawall particularly the section north of The Towers and feels the State should undertake full structural evaluation and target funding for repairs as necessary.

Action 20: Property Protection, Structural Projects and Maintenance – Route 1A

Conduct a structural analysis of the Ocean Road segment of Route 1A and identify funding to undertake appropriate repairs and/or reconstruction. The Ocean Road segment of State Route 1A has suffered repeated impacts from major storms over the years and may be deteriorating at a faster rate than the remainder of the highway. Special attention should be made to the segment between The Towers and the Town Beach.

- Lead: RI DOT
- Other responsible parties: None
- Financing options: FHWA
- Cost: Unknown
- Time frame: Medium-term

Current Status: This is a new action for the Hazard Mitigation Plan Update.

Action 21: Public Information, Outreach and Incentive Programs - Signage

Use informational signs at areas of historic flooding showing the 1938 surge elevations along Ocean Road. These signs could be as simple as a painted blue ring around a telephone pole or a plaque indicating where floodwaters have reached. It is especially important to include inland areas where the risk is not as obvious.

- Lead: Public Works Department
- Other responsible parties: State Floodplain Manager, Town Planner, and NWS
- Financing options: Town Budget
- Cost: Minimal
- Time frame: Medium-term

Current Status: The Town has not accomplished this mitigation action. The Town is still interested in this project but has not had adequate staffing or funding to undertake this action.

Action 22: Emergency Services - Bypass Sewer Main

The town engineer will develop a procedure for bypassing the main sewer that runs underneath the road during a natural hazard.

- Lead: Town Engineer
- Other responsible parties: Public Works Department
- Financing options: Town Budget
- Cost: Staff Time and Purchase of Large Portable Pump/Hoses (\$25,000 purchase price)
- Time frame: Short-term

Current Status: The Town has not yet established a formal written bypass procedure. If Ocean Road is destroyed by a storm, they would plug off sewer lines where they could get at them and then they would assess what would/could be rebuilt. The LHMC decided to reword this action item and deleted “Because relocating the main sewer line underneath the road is not financially feasible at this time” and this procedure will not include closing Ocean Road as indicated in the 1999 Hazard Mitigation Plan.

Action 23: Post-disaster Opportunities - Relocate Main Sewer Line

After a storm event, the town may want to revisit the idea of moving the main sewer line back to Boon Street, especially if the town is eligible for federal disaster assistance. This would also be a good time to have a structural assessment done for the seawall, and, if money is available, to rebuild so that it can withstand a 20-to 50-year storm event.

- *Lead: public works department*
- *Other responsible parties: town engineer, RI CRMC, U.S. Army Corps of Engineers and RI DOT Financing options: RIEMA, U.S. Army Corps of Engineers and FEMA federal disaster assistance, RI DOT (TEA-21)*
- *Cost: \$30 million*
- *Time frame: following a storm event*

Current Status: The LHMC has deleted this action item. This is not a practical alternative. The Town would be committed to any repair of the sewer line, but would not be relocating it.

Vulnerable Area #4

Sanitary Sewer/Water Lines and Mains

Action 24: Property Protection, Structural Projects and Maintenance - Utility Shut-Off Valves

Install shut-off valves for utilities, including sanitary sewers, water mains, gas mains and underground electric lines, that cross bridges that have been destroyed in previous floods (Middlebridge Bridge, Great Island Bridge, Potter Pond Inlet Bridge, Lacy Bridge and Sprague Bridge).

- *Lead: town engineer*
- *Other responsible parties: Providence Energy Corporation and Narragansett Electric*
- *Financing options: town budget, Clean Water Finance Agency (CWFA) and FEMA disaster assistance funds*
- *Cost: variable*
- *Time frame: medium-term*

Current Status: There are currently redundancies in the supply points for water. This project is complete for what the Town of Narragansett can control. There are shut-off valves for necessary utilities, sanitary sewers, water mains. The Town does not control gas mains, this is the responsibility of National Grid. The electric lines are all overhead. Middlebridge is a RIDOT bridge and South Kingstown and United Water have utility lines under it. Great Island Bridge is also a RIDOT bridge, the Town has a water line hung from the bridge but it is not in active use. The active water line to Great Island was installed as an under-channel line in 2006, and is buried well below the channel bottom, with shut-offs on either side. Potter Pond Bridge is in South Kingstown, and the Town of Narragansett has no town utilities in place. The Town has also installed an under-channel water line in 2006 between Galilee and Jerusalem to be the primary feed for Jerusalem. The Town can also feed portions of South Kingstown up to the Potters Pond Bridge if the bridge is impassable. Lacey Bridge is a RIDOT bridge with no Town utilities. Sprague Bridge is a RIDOT bridge. Narragansett has a sewer force main under the bridge. It can be shut off, but the Town then loses the ability to provide sewer service to the entire north end. The Town would look to float a temporary pipe across the river to continue sewer flow. There is currently no written plan in place for this.

Action 25: Public Information, Outreach and Incentive Programs - ISDS

Some advanced treatment ISDSs have a switch for the pump that can be turned off in order to protect the system from power surge or brown out. A public outreach program or pamphlet will educate homeowners of this safety precaution.

- *Lead: town engineer*
- *Other responsible parties: CWFA and RI DEM Financing options: town budget*
- *Cost: variable*
- *Time frame: medium-term*

Current Status: The ISDS acronym is now Onsite Wastewater Treatment System (OWTS). The LHMC is deleting this mitigation action. The Town implements a four year mandatory pumping. The compliance rate is extremely high. The LHMC sends out reminders to homeowners to pump OWTS.

Action 26: Emergency Services - Close Water Main to Jerusalem

Because relocating the water pipeline along Succotash Road is too expensive to pursue at this time, roads will be closed during a hurricane warning and the town will shut down the water line (see town engineer for procedure). Town officials will provide bottled water and notify homeowners of precautionary actions. Alternative water sources and a backup plan will be identified in the emergency operations plan.

- *Lead: public works department, South Kingstown and Narragansett water departments and Narragansett engineering department*
- *Other responsible parties: CWFA*
- *Financing options: town budgets and overtime*
- *Cost: variable*
- *Time frame: depends on storm activity*

Current Status: The Town has installed an under-channel water line to feed Jerusalem from Galilee that is the primary service. It is buried beneath the channel and protected. The water line would still be shut off to prevent any damage. The Town is satisfied that they have enough valves to manage and mitigate damage. This mitigation action will be deleted.

Action 27: Emergency Services - Sewage Treatment

Because septic systems and sewer systems are located in floodplain areas, widespread contamination can be expected during a major flood event. Plan ahead for pumping out the sewage in low-lying areas and have chemical toilets ready if necessary.

- *Lead: South Kingstown public works department, engineering department and water department*
- *Other responsible parties: CWFA*
- *Financing options: town budgets and overtime*
- *Cost: variable*
- *Time frame: depends on storm activity*

Current Status: This mitigation action will be deleted. This is an individual homeowner responsibility. The Town currently monitors and enforces the required four year pumping. Chemical toilets are beyond the Town's financial capability.

Action 28: Emergency Services – Water Main Closures

Formalize the protocol for closure of water mains throughout the Town. The Water Division of Narragansett will create standard operating procedures.

- Lead: Town Engineer
- Other responsible parties: Water Superintendent
- Financing options: Town Budget
- Cost: No cost
- Time frame: Short-term

Current Status: This is a new mitigation action for the Town.

Vulnerable Area #5

Narragansett Beach and Pavilion/Bonnet Shores Beach Club

Action 29: Planning and Regulations - Maintenance and Shore Management Plan

Create a maintenance and shore management plan for Narragansett Beach, its pavilion, the Dunes Club and Bonnet Shores. Include sand fencing, dune grass and beach nourishment.

- Lead: Town Engineer
- Other responsible parties: Town Planner and the Dunes Club
- Financing options: Beach Fund (Town Budget)
- Cost: \$65,000
- Time frame: Short-term

Current Status: The Town did some dune grass re-planting in 2008 and 2009 in between the areas of the North Pavilion and the South Pavilion. The Town annually replaces the dune fencing that protects the seaward face of the sand dunes on Narragansett Town Beach. The Woods Hole Group is studying the shoreline erosion and potential mitigation and beach reclamation schemes. The study is currently underway. The Town will continue with the action item once the study is complete to create a maintenance and shore management plan for the identified area once funding sources have been identified.

Action 30: Planning and Regulations - Beach Pavilions

Plan for appropriate elevation and breakaway construction of future beach pavilions. Plan for and acquire a new site for reconstruction for any or all of the existing beach pavilions that are more than 50 percent damaged in the future.

- Lead: town planner
- Other responsible parties: RI CRMC, parks and recreation department, and public works department
- Financing options: beach fund (town budget) Cost: \$25,000 to repair + \$1 million to relocate Time frame: medium-term

Current Status: The Pavilions are built according the current code and above the flood elevation. The improvements to the North Pavilion will be completed in Spring 2012 making this action complete.

Action 31: Planning and Regulations - Town Beach Parking Lot

The entire town beach parking lot (south and north) is paved. Narragansett will investigate turning half the parking lot surface to gravel, which is a less impervious surface. The downslope toward the front end of the parking lot (Route 1A side) would need to remain paved. The town has available equipment that turns the pavement into gravel.

- *Lead: town planner*
- *Other responsible parties: RI CRMC and parks and recreation department*
- *Financing options: beach fund (town budget) Cost: \$5,000*
- *Time frame: long-term*

Current Status: The LHMC deleted this mitigation action. It is not a viable or reasonable alternative.

Action 32: Property Protection, Structural Projects and Maintenance - Evacuation Routes

The Bonnet Point area is subject to isolation by flooding near the intersection of Bonnet Point Road and Camden Road. Preliminary data indicates that an evacuation route could be established for the Bonnet Point area if a section of Camden Road (near its intersection with Bonnet Point Road) were elevated by 2.5 to 3.5 feet to meet the 100-year flood level. The Town and the Bonnet Shores fire district should investigate this possibility. The project would need careful study because elevating the road may affect flooding on adjacent properties and on local drainage patterns during normal rain events.

- *Lead: public works department*
- *Other responsible parties: fire chief (local EMA director), police department and RI CRMC*
- *Financing options: town budget, RI DOT (TEA-21)*
- *Cost: \$1 million*
- *Time frame: short-term*

Current Status: The LHMC will delete this mitigation action. This is not a cost-effective mitigation action, nor is it necessary to evacuate the residents.

Action 33: Public Information, Outreach and Incentive Programs - Educational Display for Flood Zones

Create an interpretive display with photos and maps of prior flood damage. This display will be located in the Town Hall.

- *Lead: Planning Department*
- *Other responsible parties: Historic District Commission*
- *Financing options: Town Budget*
- *Cost: \$1000*
- *Time frame: Medium-term*

Current Status: This has not been accomplished; the Planning and Engineering Departments will look to accomplish this task in the term of this plan. The LHMC added that this display will be in the Town Hall and not at the beach or in the parking lot.

Action 34: Emergency Services - Close Beach to the Public

During storm events, the police department will keep people away from the town beach, the parking lot and nearby access roads.

- *Lead: police department*
- *Other responsible parties: public works department and fire chief (local EMA director)*
- *Financing options: town budget*
- *Cost: staff time*
- *Time frame: short-term*

Current Status: The LHMC will delete this action item. It is not a mitigation action this is a response item that the police department will address in their standard operating procedures.

Action 35: Post-disaster Opportunities - Sand Overwash

Sand overwash will be cleared off the streets and temporarily stored on the beach parking lots until the debris can be separated and the sand can be returned to the beaches.

- Lead: Public Works Department
- Other responsible parties: RI DOT
- Financing options: Town Budget, RI DOT
- Cost: Staff Time and indeterminate based on the storm
- Time frame: Short-term

Current Status: This is an ongoing action item. This is addressed after each storm.

Vulnerable Area #6

Great Island Bridge/Lacy Bridge/Middlebridge Bridge

Action 36: Planning and Regulations - Evacuation and Water Supply

Plan for early evacuation for Great Island, Harbor Island, Jerusalem, Bridgetown Road, Middlebridge along the Narrow River and roads in floodplains. Suspend water lines underneath the bridge and place hydrants on either side of the bridge (Middlebridge) where appropriate so that a suction hose can be floated between hydrants.

- Lead: Police Department
- Other responsible parties: EMA Director, RI DOT, and RIEMA
- Financing options: Town Budget, FEMA Grants
- Cost: \$15,000
- Time frame: Medium-term

Current Status: Great Island is complete because the Town completed the under-channel line. Middlebridge is owned by United Water and the Town does not have any authority to complete this action item; however it is a PUC regulated authority. The Town will work with United Water to complete this task.

Action 37: Property Protection, Structural Projects and Maintenance - Maintain Bridge Quality

Keep bridges well maintained. If funding is available through either FEMA disaster assistance grants or as part of another bridge improvement project, the approaches should be elevated on land but not high enough to allow boat traffic under the bridges. Currently, this action may not be financially feasible, but the LHMC should consider this idea if funds are available in the future.

- Lead: RIDOT
- Other responsible parties: None
- Financing options: FEMA 404 grants, RI DOT
- Cost: \$3 million
- Time frame: Long-term

Current Status: The bridges are owned and maintained by RIDOT. Middlebridge was replaced in 2004-2005. The Town will continue to work with RIDOT on a replacement schedule of the other state owned bridges. The Town has not applied for any grant funding for these projects as they are state

owned and maintained, however the Town sees the importance of this project and will initiate the discussions for potential grant applications in the near future.

Action 38: Public Information, Outreach and Incentive Program - Signage

Post signs that indicate where major access routes are and that early evacuation is necessary

- *Lead: public works department*
- *Other responsible parties: town planner and RI DOT Financing options: town budget, RI DOT (TEA-21) Cost: \$500*
- *Time frame: medium-term*

Current Status: This is complete. State roads are already marked with evacuation signs.

Action 39: Emergency Services - Inter-town Coordination

Strengthen jurisdiction with South Kingstown, establish alternative evacuation routes and place evacuation signs along the locally established evacuation routes. The LHMC would like to post evacuation signs at traffic control points, indicated on Map 2 by green dots. When necessary, shut off the sewer line under Middlebridge Road at the pumping station in South Kingstown.

- *Lead: fire chief (local EMA director)*
- *Other responsible parties: town planner and South Kingstown public works department*
- *Financing options: town budget*
- *Cost: \$1,000*
- *Time frame: medium-term*

Current Status: The LHMC has decided to delete this action item. The reference to the sewer line under Middlebridge Road is a South Kingstown asset and is their responsibility to shut down when necessary. The Town does not need any more evacuation signs and what are posted are sufficient.

Action 40: Post-disaster Opportunities - Bridge Improvements

See Action 32 - Maintain Bridge Quality. Suspend water lines underneath the bridge and place hydrants on either side of the bridge where appropriate so that a suction hose can be floated between hydrants.

- *Lead: South Kingstown and Narragansett town engineers for Middlebridge and RI DOT for other bridges*
- *Other responsible parties: RI CRMC*
- *Financing options: FEMA 404 grants and RI DOT (TEA-21) Cost: \$3 million*
- *Time frame: long-term*

Current Status: The LHMC decided to delete this mitigation action. This is repetitive of other actions.

Vulnerable Area #8

Point Judith Pond Shoreline

Action 41: Planning and Regulations - Open Space Floodplain Preservation and Hazard Mitigation

Monitoring. As with Vulnerable Areas #1 and #3, both these activities will be conducted for the Point Judith shoreline

- *Lead: planning director*

- *Other responsible parties: state floodplain manager, RI CRMC, and RIEMA*
- *Financing options: town budget*
- *Cost: no cost*
- *Time frame: depends on storm activity*

Current Status: The current LHMC does not know what this action relates to and therefore will delete this action item. The Town does not conduct active monitoring of the shoreline.

Action 42: Planning and Regulations - Policy for Rebuilding

Continue to enforce FEMA regulations for Point Judith Pond shoreline regarding rebuilding following substantial damage. All new structures will be elevated to FEMA regulations and retrofitted to withstand future damages.

- *Lead: Building Inspector*
- *Other responsible parties: State Floodplain Manager, RIEMA and State Building Commission*
- *Financing options: Town Budget*
- *Cost: No Cost*
- *Time frame: Depends on Storm Activity*

Current Status: This is part of the ongoing policy and standard practice for the Building Official by enforcing the State Building Code. The Town has an inordinate number of demolitions and rebuilds and whenever someone rebuilds they must comply with all FEMA regulations. The LHMC feels this is still extremely important to keep within the plan but it will virtually never be completed.

Action 43: Property Protection, Structural Projects and Maintenance - Retrofit or Relocate

In the floodplain, elevate structures to the 100-year base flood elevation and set back damaged structures. Properties located in V zones are at higher risk and should be dealt with separately. Encourage maximum setbacks and relocation. While retrofitting for flood, light structural and non-structural projects can easily be done at the same time that could help protect a home from wind and earthquake shaking, providing a greater benefit at a lower cost. FEMA manuals are available on construction practices for non-residential structures.

- *Lead: Building Official*
- *Other responsible parties: Town Engineer, Town Planner*
- *Financing options: FEMA Grants*
- *Cost: Varies Depending on Structure*
- *Time frame: Medium-term*

Current Status: The Town currently encourages maximum setbacks and relocation. The Town has stricter policies within the flood zone by enforcing the State Code and the Local Floodplain Overlay Ordinance which has been in place since 1987. The policies have become stricter since October 2010. The Town will keep this mitigation action and will seek federal funds when available to assist property owners in low lying areas to retrofit their properties.

Action 44: Post-disaster Opportunities - Acquisition See Action 1

- *Lead: Narragansett Land Conservancy Trust*
- *Other Response Parties: Narrow River Land Trust, building inspector, town council, FEMA and RIEMA*

- *Financing Options: FEMA grants, land acquisition bonds (state and municipal), land bank, and RI DEM*
- *Cost: Variable*
- *Time frame: Long-term*

Current Status: The LHMC deleted this action item. It is covered in Action 1.

Vulnerable Area #9

Tree Damage

Action 45: Planning and Regulations - Tree Trimming Program

Work with local utility companies to develop a program for regular tree trimming.

- Lead: Public Works Department
- Other responsible parties: RI DOT, RI DEM and local utility companies
- Financing options: Town Budget and Donations from local utility companies
- Cost: Regular Maintenance Cost
- Time frame: Short-term

Current Status: The Town of Narragansett will continue to work with utility companies to develop a program for regular tree trimming. The Town issues permits to the utility companies to trim trees in public right of ways. The Town's goal is to formalize a written standard operating procedure with the utility companies.

Action 46: Property Protection, Structural Projects and Maintenance - Removal of Hazardous Tree Limbs
Remove dead trees near private homes and trim trees around power lines.

- Lead: Utility Companies in Public Rights-of-Way and Private Owners on Private Property
- Other responsible parties: Public Works Department, Utility Companies and Private Homeowners
- Financing options: Town Budget, Utility Company Budgets
- Cost: Regular Maintenance Cost
- Time frame: Medium-term

Current Status: The Town's Tree Board is working with the Town's Tree Warden to draft a Tree Management Plan for municipal right of way trees and trees on public property. This is anticipated to be completed in 2012.

Action 47: Public Information, Outreach and Incentive Programs for Private Homeowners

The town will create a public education program for private homeowners on such information as how to minimize the dangers of windborne debris.

- Lead: Local EMA Director
- Other responsible parties: Public Works Department, Building Inspector
- Financing options: Town Budget
- Cost: Educational Materials (~\$400) plus staff time
- Time frame: Medium-term

Current Status: The Tree Board will undertake this action item. The Town has not started this mitigation action because of time restraints. However, once the Tree Management Plan is completed the Tree Board will create a public information campaign.

Action 48: Emergency Services - Fire Lanes and Fire Breaks

Create fire lanes and fire breaks in high risk areas such as the Galilee Bird Sanctuary and the open space land along Boston Neck Road.

- Lead: Fire Chief
- Other responsible parties: Public Works Department
- Financing options: Town Budget
- Cost: Regular Maintenance Cost
- Time frame: Short-term

Current Status: The LHMC deleted this action. Upon further review, the committee determined this is not a necessary mitigation action.

Action 49: Post-disaster Opportunities - Debris Management

Establish plans for debris removal and disposal (try to chip some wood on-site). An area associated with a coastal feature must have RI CRMC's approval before removing or disposing of debris. Areas to consider: Narragansett Pier Town Beach parking lot (RI CRMC), Scarborough State Beach, Fisherman's Memorial State Park in Galilee, Water Tower Park in Snug Harbor, the land west of the state pier in Jerusalem and the North End playground. A separate area will be assigned for collection of propane tanks that have been mixed in with the other debris.

- Lead: Public Works
- Other responsible parties: RI DOT, RI DEM and local utility companies
- Financing options: Town Budget
- Cost: Regular Maintenance Cost
- Time frame: Depends on Storm Activity

Current Status: After Tropical Storm Irene, the Town saw the need to contract services for debris management and removal. The Town will begin drafting a plan and policy over the next year and will also look to competitively bid debris management and removal services for future events.

Vulnerable Area #10

Galilee

Action 50: Property Protection, Structural Projects and Maintenance - Breakwater

The Harbor of Refuge has over two miles of stone breakwater. The approximate elevation of the breakwater is +8.75 feet above mean sea level. Although in disrepair, it is relatively effective in reducing the waves in the harbor. The design is adequate for a storm of a 10 year frequency (10 percent chance of occurrence in any year). If money is available and if this project is compliant with RI CRMC's regulations, repairs should be made immediately, especially to the center section.

- Lead: U.S. Army Corps of Engineers
- Other responsible parties: RI CRMC
- Financing options: U.S. Army Corps
- Cost: \$1,000,000

- Time frame: Medium-term

Current Status: The Town has not been able to accomplish this action because this is owned by the Army Corps of Engineers. The Town will work with the Army Corps of Engineers to complete this action pending availability of resources. The Town has a vested interest in the project because the sand removal of the sand bar near the apex of the center wall can assist the Town of beach replenishment.

Action 51: Public Information, Outreach and Incentive Programs - Hazard Disclosure

The local building official will provide hazard disclosure for businesses considering moving to Galilee. The fire chief (local EMA director) should create flyers to distribute to businesses containing safety precautions they can take to prepare for storms, such as securing petroleum tanks before flood events.

- Lead: State Building Inspector
- Other responsible parties: RI DEM, Local EMA Director, and State Fire Marshal's Office
- Financing options: State Budget
- Cost: \$2,000
- Time frame: Medium-term

Current Status: The LHMC reworked this action. They deleted the sentence about installing a plaque for a high water mark as they did not feel this was necessary for this mitigation action. Fuel tanks in a floodplain have to be secured according to code. The Town has not undertaken a public information campaign because of lack of personnel to support the action. The Town will work to incorporate this into the public information program of the Narragansett Emergency Management Agency however all new structures built in Galilee have to comply with code.

Action 52: Emergency Services - Early Evacuation and Safety Precautions

Early evacuation of Galilee should be encouraged. Before evacuating, businesses should secure loose outdoor furniture/structures in order to minimize windborne debris. The building inspector will make visits to this area to assure these precautions are being taken.

- Lead: Fire Chief (Local EMA Director)
- Other responsible parties: Police Department and Building Inspector
- Financing options: Town Budget
- Cost: Staff Time
- Time frame: Depends on Storm Activity

Current Status: The Town educates Town residents and businesses of the hazards of windborne debris. The land associated with Galilee is all state-owned. The Town has no authority to enforce any regulations on these businesses. The Town building inspector will work with the State Building Commissioner's Office to discuss ways to prepare and mitigate issues in Galilee. At this point, this action has not been completed because of lack of personnel.

Action 53: Post-disaster Opportunities - Policy for Rebuilding

Continue to enforce FEMA regulations for Galilee regarding rebuilding following substantial damage. Severely damaged structures will need to be relocated or elevated to within FEMA regulations.

- Lead: State Building Inspector
- Other responsible parties: State Floodplain Manager, RIEMA and State Building Commission

- Financing options: Town Budget
- Cost: No Cost
- Time frame: Depends on Storm Activity

Current Status: The Town does not have any authority on building permits or code issues in Galilee. It is all state-owned. Again, the Town will work with the State Building Commissioner's Office to complete this mitigation action. This action has not been completed because of lack of personnel.

Vulnerable Area #11

Sewage Treatment Facility

Action 54: Property Protection, Structural Projects and Maintenance - Retrofit

South End (Scarborough) sewage treatment plant is located in a flood zone (A zone with an elevation of 17 feet). If substantial erosion occurs, this area could become a V zone with breaking wave action. The influent pumping station (small area) should be floodproofed. Purchase pre-cast concrete blocks that lock together to form a chain and build a dike around the substation when a hurricane warning goes into effect. The town has access to a portable pump, which can be set up with 3 to 4 hours notice.

- Lead: Engineering Department
- Other responsible parties: None
- Financing options: Town Budget
- Cost: \$5,000 for block system, \$25,000 for large portable pump/hoses
- Time frame: Depends on Storm Activity

Current Status: The LHMC deleted the sentence indicating that there was "significant erosion." They did not feel this sentence was valid. This action has not occurred because they have not determined an appropriate permanent solution. They have purchased two portable pumps but they would still like to purchase the pre-cast blocks. They also deleted "The town will consider purchasing a pump for the sewage station that serves the entire south end of town including Point Judith and Galilee." This is not a practical solution.

Action 55: Post-disaster Opportunities - Relocate

The town should consider using post-disaster funds to relocate the sewage treatment facility if it is damaged during a storm, as it could pose a health hazard to the community.

- Lead: engineering department
- Other responsible parties: public works department
- Financing options: town budget
- Cost: \$7 million
- Time frame: post-disaster

Current Status: The LHMC has decided to delete this action as it is impractical for the Town.

Vulnerable Area #12

Sewage Pumping Station

Action 56: Planning and Regulations - Shut Off Service

During a flood event, the town engineer should consider shutting off sewage service to the following neighborhoods: Wolfe Road, Allagash Trail, Sprague Bridge, Mettatuxet, Galilee and Stanton Avenue. The engineer should also plan to have alternative facilities available in an upland area that is close to these neighborhoods.

- *Lead: engineering department*
- *Other responsible parties: public works department*
- *Financing options: town budget and FEMA Flood Mitigation Assistance Program*
- *Cost: staff time*
- *Time frame: medium-term*

Current Status: The LHMC decided to delete this action item. It is not sanitary or practical to shut down the sewer system unless the neighborhood was completely evacuated.

Action 57: Property Protection, Structural Projects and Maintenance - Floodproof

Floodproof sanitary sewer pump stations (15) giving highest priority to Scarborough, Bonnet Shores (Allagash) and Congdon Street.

- **Lead: Engineering Department**
- **Other responsible parties: None**
- **Financing options: Town Budget and FEMA Flood Mitigation Assistance Program**
- **Cost: \$30,000**
- **Time frame: Long-term**

Current Status: The Scarborough pump station is addressed in Action 55. For the Congdon Street pump, a gravity sewer bypass has been installed. The Town is still determining a way to accomplish this task for the remaining pump stations. This task has not been accomplished because of lack of design ideas. This action is behind schedule and the Town anticipates seeking design ideas and implementation within the next five years.

Action 58: Emergency Services - Emergency System

An emergency system should be in place to pump any overflow into some type of temporary container until it can be treated (such as tank trucks to transport sewage to regional wastewater treatment facility, which is well above the floodplain).

- *Lead: engineering department*
- *Financing options: town budget and FEMA Flood Mitigation Assistance Program*
- *Cost: \$10,000 per day for by-pass pumping/trucking*
- *Time frame: medium-term*

Current Status: The LHMC deleted this action item. It is not a practical solution.

Action 59: Post-disaster Opportunities - Retrofit

Narragansett will consider retrofitting any sewage pumping stations that had problems during the storm.

- **Lead: Engineering Department**
- **Other responsible parties: None**
- **Financing options: Town Budget, FEMA Mitigation Grants**
- **Cost: \$200,000**
- **Time frame: Medium-term**

Current Status: The LHMC deleted “relocate” as they will not relocate any pumping stations. They will consider retrofitting pumping stations that have problems during storm events. The Town has not acted on this action because to date the Town has not yet had any problems that have required retrofitting.

Deleted Vulnerable Areas

Vulnerable Area #7

Bridge: Potter Pond Bridge/Succotash Road

The LHMC decided to delete this vulnerable area from the Hazard Mitigation Plan. This Vulnerable Area is not located within the Town of Narragansett. The Town will support South Kingstown in any mitigation actions that they may undertake as the Town of Narragansett will be impacted by mitigation actions for this Vulnerable Area for evacuating the Town during a hurricane or other natural hazard.

Action 60: Planning and Regulations - Evacuation

Strengthen joint jurisdiction role with South Kingstown to create a joint evacuation policy for Jerusalem residents, boaters and fishermen.

- *Lead: Town Manager*
- *Other responsible parties: RIEMA, RIDOT and police department*
- *Financing options: Town Budget*
- *Cost: Staff Time*
- *Time frame: Short-term*

Current Status: This action will be deleted as described above.

Action 61: Property Protection, Structural Projects and Maintenance - Reconstruction and Elevation

Succotash Road and the bridge over Potter Pond inlet will be reconstructed to a 100-year base flood elevation. Options are to either build up the road and the approaches to the bridge, or replace the bridge with a wooden bridge, which is cheaper to repair and, because it is biodegradable, will pose less of a debris problem if it washes out. RI DOT has submitted plans to RI CRMC for rebuilding this bridge.

- *Lead: Public Works Department*
- *Other responsible parties: RIDOT, South Kingstown and RIEMA*
- *Financing options: FEMA 404 grants, RIDOT (TEA-21)*
- *Cost: \$750,000*

Current Status: This action will be deleted as described above.

Action 62: Property Protection, Structural Projects and Maintenance - Water Line

Suspend the water line under the Potter Pond bridge and add hydrants on either side.

- *Lead: Public Works Department*
- *Other responsible parties: RI CRMC engineer, fire chief (local EMA director), RIDOT, RIEMA and South Kingstown*
- *Financing options: FEMA 404 grants*

- Cost: \$18,500
- Time frame: Short-term, depending on funding

Current Status: This action will be deleted as described above.

Action 63: Public Information, Outreach and Incentive Programs - High Water Line Marker

A plaque that indicates the high water line from past storms should be placed on or near the bridge along with information about past damage to the bridge.

- Lead: Town Planner
- Other responsible parties: Public Works Department and South Kingstown
- Financing options: Town Budgets
- Cost: \$200
- Time frame: Medium-term

Current Status: This action will be deleted as described above.

Action 64: Emergency Services - Early Evacuation

Even though evacuation is not mandatory in Narragansett, the fire chief (local EMA director) should work with the South Kingstown emergency management director to encourage early evacuation of Jerusalem after a hurricane warning has been issued. Police should guide traffic to alternate evacuation routes.

- Lead: Fire Chief (local EMA Director)
- Other responsible parties: South Kingstown EMA Director, South Kingstown and Narragansett Police Departments, RIDOT, and RIEMA
- Financing options: Town Budgets
- Cost: Staff time
- Time frame: Short-term

Current Status: This action will be deleted as described above.

Action 65: Post-disaster Opportunities - Rebuild

See Action 37 - Reconstruction and Elevation. If this bridge is washed out during a disaster, the town should consider rebuilding with a wooden bridge.

- Lead: Public Works Department
- Other responsible parties: RI CRMC, RIDOT, RIEMA and South Kingstown
- Financing options: FEMA 404 grants, RIDOT (TEA-21)
- Cost: \$750,000
- Time frame: Long-term

Current Status: This action will be deleted as described above.

Vulnerable Area #13

Fisherman's Memorial Park

Action 66: Property Protection, Structural Projects and Maintenance - Tree Trimming

In addition to the town-wide tree trimming program, special attention should continue to be given to the state park in order to decrease the amount of debris generated during heavy winds. RI DEM has initiated an extensive tree trimming program over the past three years.

- *Lead: RI DEM*
- *Financing options: RI DEM Cost: \$8,000/month*
- *Time frame: short-term*

Current Status: The LHMC decided to delete this action item. This is a State asset. The Town will support the State in any mitigation actions they consider but do not feel that this is a priority for the Town.

Action 67: Public Information, Outreach and Incentive Programs - Plan and Signage

This is a high wind area near a flood zone. The town will establish an evacuation plan and post evacuation signs. RI DEM will educate campers about proper safety precautions.

- *Lead: RI DEM*
- *Other responsible parties: RIEMA and RI DOT*
- *Financing options: RI DEM, U.S. Army Corps of Engineers and RIEMA Cost: staff time*
- *Time frame: medium-term*

Current Status: This action is complete. The Town has posted evacuation signs and have worked with Rhode Island State Police to create an evacuation plan.

Action 68: Emergency Services - Close the Park

The park will be closed during severe hurricanes. Police and RI DEM should monitor the area and provide assistance to any campers in need of shelter or help evacuating.

- *Lead: RI DEM*
- *Other responsible parties: police department*
- *Financing options: RI DEM Cost: staff time*
- *Time frame: depending on storm activity*

Current Status: This action is complete. This is a SOP for RI Department of Environmental Management and the Town assists in evacuations if there are any law enforcement issues during evacuation.

Action 69: Post-disaster Opportunities - Plan for Debris Clearing

The RI DEM should have a plan for debris clearing. The LHMC should approve a location where the debris will be gathered temporarily.

- *Lead: RI DEM*
- *Other responsible parties: RIEMA and public works department*
- *Financing options: RI DEM and town budget*
- *Cost: staff time*
- *Time frame: medium-term*

Current Status: The LHMC deleted this action item. This is a State asset and the State will determine their own temporary disposal sites.

Vulnerable Area #14

Beechwood Apartments (elderly housing)

Action 70: Property Protection, Structural Projects and Maintenance - Maintenance

The owner of Beechwood Apartments should have a maintenance program that includes regular tree trimming, well-kept walkways and readily available transportation for evacuation.

- *Lead: Owner of Beechwood Apartments*
- *Other responsible parties: police department*
- *Financing options: Beechwood Apartments maintenance fund and town budget*
- *Cost: \$2,000/year*
- *Time frame: short-term*

Current Status: The LHMC deleted this mitigation action.

Action 71: Emergency Services - Evacuation

This facility needs to have a well-planned and practiced evacuation procedure. The residents have special needs that must be considered, and evacuation of the building will take longer than with other local facilities its size.

- *Lead: fire chief (local EMA director)*
- *Other responsible parties: police department and public works department*
- *Financing options: town budget*
- *Cost: Overtime, \$2,000 variable cost depending on length and type of response necessary*
- *Time frame: short-term*

Current Status: The LHMC deleted this mitigation action.

Action 72: Post-disaster Opportunities - Lessons Learned

Municipal officials (in particular the fire chief/local EMA director and the town planner) should work with the Beechwood Apartment residents to document lessons learned from past storms in order to be more prepared for the next storm.

- *Lead: fire chief (EMA director)*
- *Other responsible parties: various town departments*
- *Financing options: town budget and FEMA Flood Mitigation Assistance Program*
- *Cost: \$6,000*
- *Time frame: medium-term*

Current Status: The LHMC deleted this mitigation action.

Vulnerable Area #15

Day Care Center

This Vulnerable Area will be deleted. The day care center has moved and this is no longer relevant.

Action 73: Public Information, Outreach and Incentive Programs - Evacuation Drills

The Growing Child day care center is located in a floodplain but has been elevated to meet the floodplain regulations. Municipal officials (police and fire departments) will hold practice evacuation drills three times during hurricane season.

- *Lead: Fire Chief (local EMA Director)*
- *Other responsible parties: Police Department*
- *Financing options: Town Budget*
- *Cost: Staff time*
- *Time frame: Short-term*

Current Status: The LHMC will delete this action because the day care center has moved. This is no longer relevant.

Action 74: Emergency Services - Early Evacuation

The day care center should have a well-planned procedure for notifying parents/guardians of early evacuation.

- *Lead: Owner of The Growing Child Day Care Center*
- *Other responsible parties: Fire Chief (local EMA Director)*
- *Financing options: The Growing Child Day Care Center and Town Budget*
- *Cost: Staff time*
- *Time frame: Short-term*

Current Status: The LHMC will delete this action because the day care center has moved. This is no longer relevant.

Action 75: Post-disaster Opportunities - Relocate

If this day care center is severely damaged during a major storm, the owner should consider using FEMA flood mitigation monies to relocate this structure out of the floodplain.

- *Lead: Owner of The Growing Child Day Care Center*
- *Other responsible parties: Building Official*
- *Financing options: FEMA Flood Mitigation Assistance Program and RIEMA*
- *Cost: Unknown*
- *Time frame: Long-term*

Current Status: The LHMC will delete this action because the day care center has moved. This is no longer relevant.

5.0 PLAN MAINTENANCE

“The success of the hazard mitigation plan is measured by the degree to which actions are accomplished. Without the implementation and maintenance of the plan, the previous components have merely been an effort in research void of any practical application.” - Tennessee Emergency Management Agency

The Town of Narragansett and the Hazard Mitigation Committee realize that successful hazard mitigation is an ongoing process that requires implementation, evaluation, and updated revisions to this plan. Also realized is the importance of integrating appropriate sections of the plan into the town’s Comprehensive Plan, Emergency Operations Plan, and site plan review process. It is intended that this plan and the

ongoing efforts of the Hazard Mitigation Committee will preserve and enhance the quality of life, property, and resources for the Town of Narragansett.

The plan was formally approved by the Town Council on September 6, 2005 and was formally adopted by the Town Council on November 15, 2005. Formal adoption of this hazard mitigation strategy gains West Warwick credit points under the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS) which provides discounts on National Flood Insurance premiums. Adoption of this mitigation strategy also increases Narragansett's eligibility for federal hazard mitigation grants. These grants originate from FEMA's Pre-Disaster Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) and post-disaster Hazard Mitigation Grant (HMGP) Programs. (Refer to Appendix B for further information.)

5.1 IMPLEMENTATION

The Local Hazard Mitigation Committee realized that assigning a time frame to each recommended mitigation action is important so that actions can be coordinated with other important governmental functions, such as committee meetings and budget hearings. Assigned time frames also provide input to a project plan which is used for tracking the progress of all activities.

In order to establish the authority and accountability for implementation, Narragansett includes amendments to its comprehensive plan that incorporate the theme of hazard mitigation. Once the plan is adopted, the actions are assigned to the responsible agencies for review and planning.

5.2 MONITORING

The Local Hazard Mitigation Committee, under the leadership of the Town Manager, will meet annually to monitor the actions contained in the plan. At each meeting the committee members will discuss the progress of their actions to ensure that they are on schedule.

5.3 EVALUATION

The Local Hazard Mitigation Committee, under the leadership of the Town Manager, will meet annually to evaluate the actions contained in the plan. The LHMC will base its evaluation on whether or not the actions have met the following criteria: increased public awareness/education, reduction in hazard damage, actions being implemented in the designated time frames, and actions staying within the cost estimate. The committee will document and report its findings to the Planning Board and Town Council. The Town Council will involve the public in the action evaluation process by holding an annual advertised public meeting in order to review the evaluation and solicit input.

5.4 REVISION

The Local Hazard Mitigation Committee, under the leadership of the Town Manager, will also evaluate and update the plan annually, after a disaster, as funding opportunities arise for the actions and projects identified in the plan, or as actions are completed in order to re-prioritize.

Any updates to the plan will be reviewed and submitted to RIEMA upon local approval. The Town Council will involve the public in the plan revision process by holding an annual advertised public meeting to present recommended revisions and solicit input. Revised plans will also be sent to South Kingstown and North Kingstown.

5.5 INCORPORATION INTO EXISTING PLANNING MECHANISMS

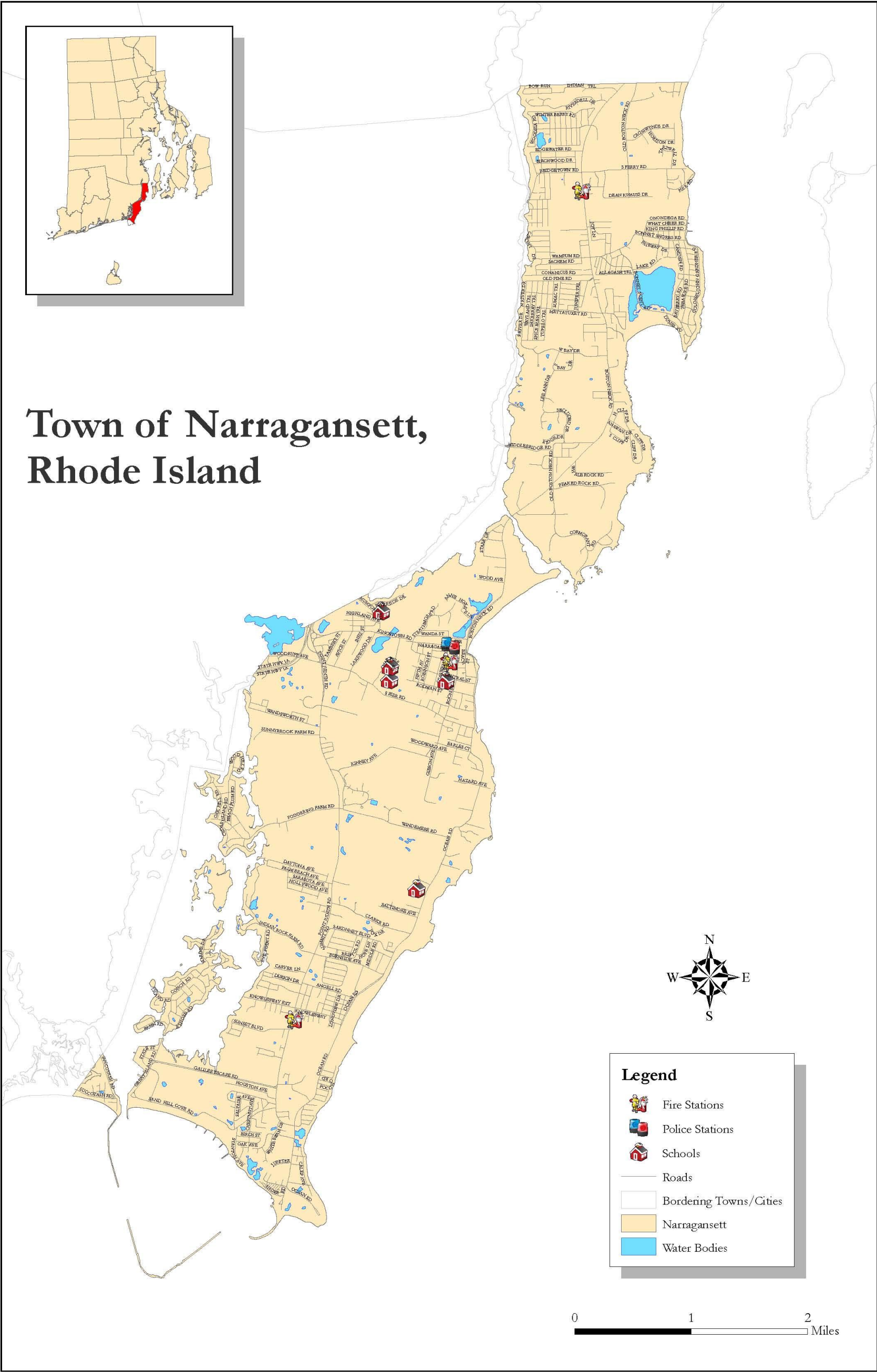
The 2005 Hazard Mitigation Plan was not been incorporated into any other planning mechanisms. The process for incorporation of plan elements into existing planning mechanisms will typically be the Emergency Manager meeting with and supporting the staff of the department responsible for drafting the plan document or conducting the planning program to ensure the relevant elements of this plan are taken into consideration.

The updated hazard mitigation plan will be utilized where appropriate into other existing planning mechanisms. These plans include, but are not limited to the Town of Narragansett Comprehensive Plan, the Town of Narragansett Emergency Operations Plan (EOP), land use plans, and capital improvement plans. The HMP will be referenced when these plans are updated if it is applicable to the plan. In the current revision of the EOP, the 2005 HMP was incorporated to illustrate the hazards the town faces. The HMP may also be incorporated into mutual aid agreements, evacuation plans, storm water management plans, and/or zoning ordinances.

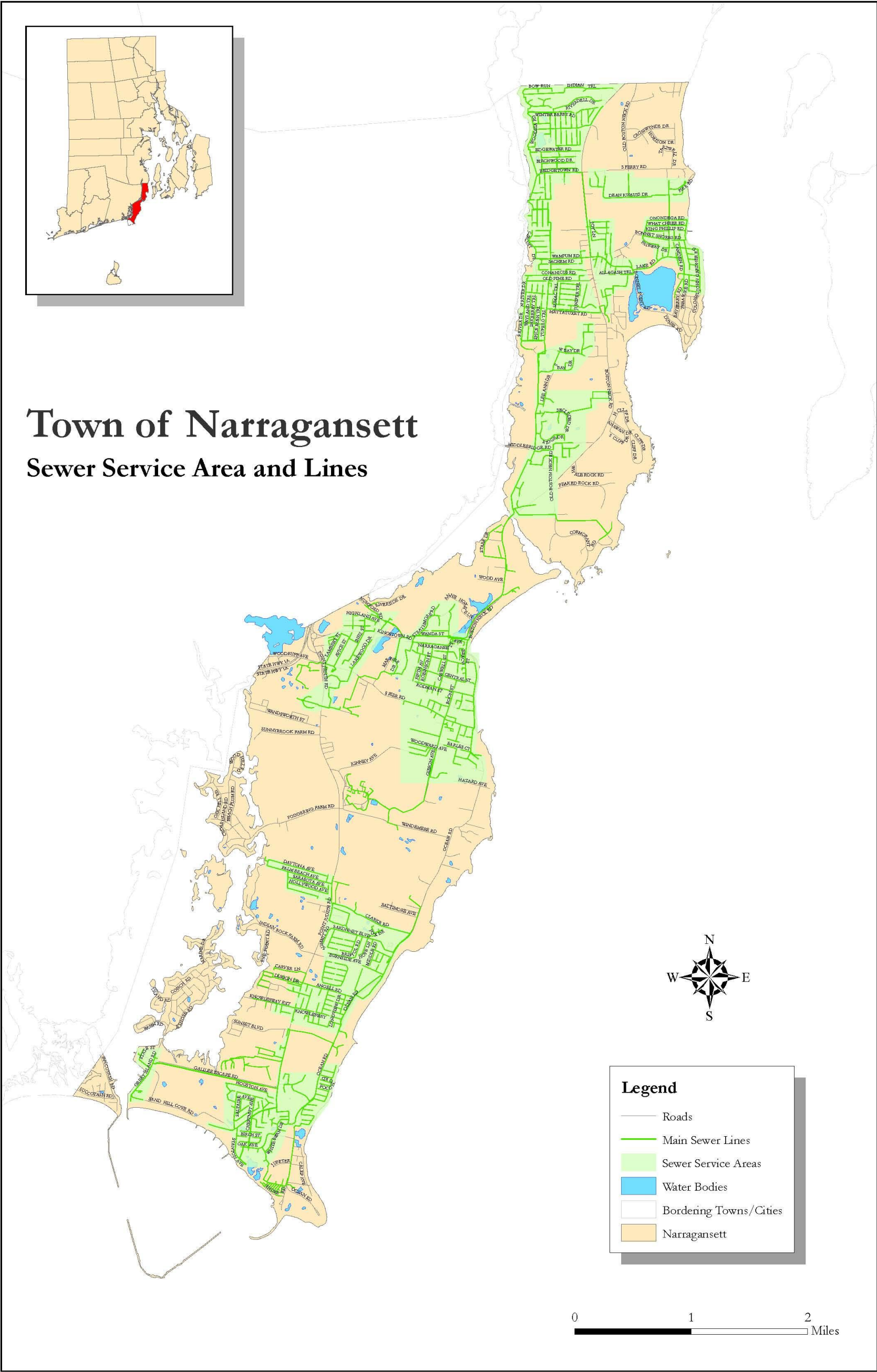
In order to establish the authority and accountability for implementation, Narragansett includes amendments to its comprehensive plan that incorporate the theme of hazard mitigation. These amendments will be based on the mitigation actions addressed within this HMP. As part of the annual update to the EOP, the Town will also utilize the HMP for necessary updates.

Maps

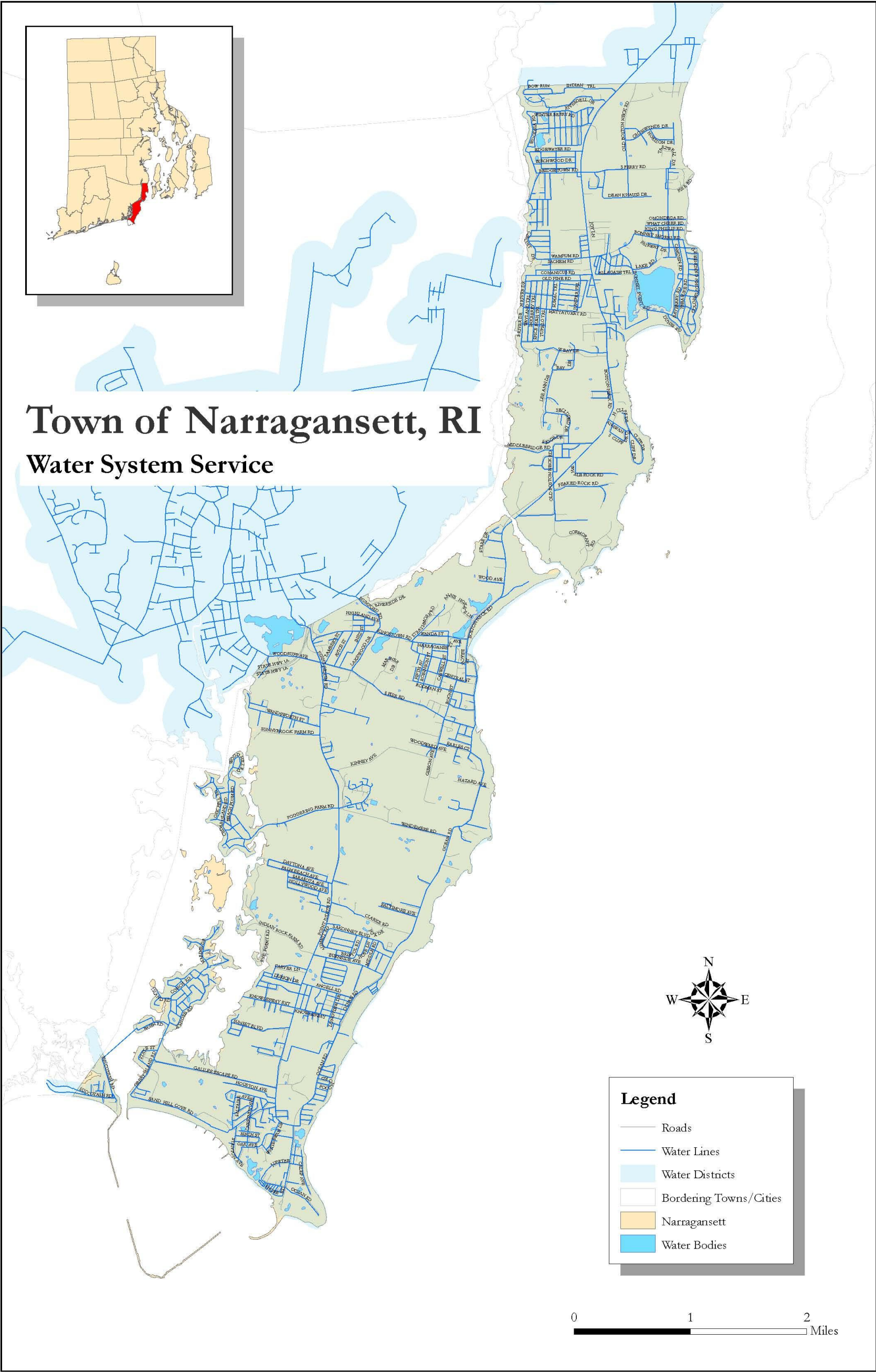
Map 1 – Community Facilities



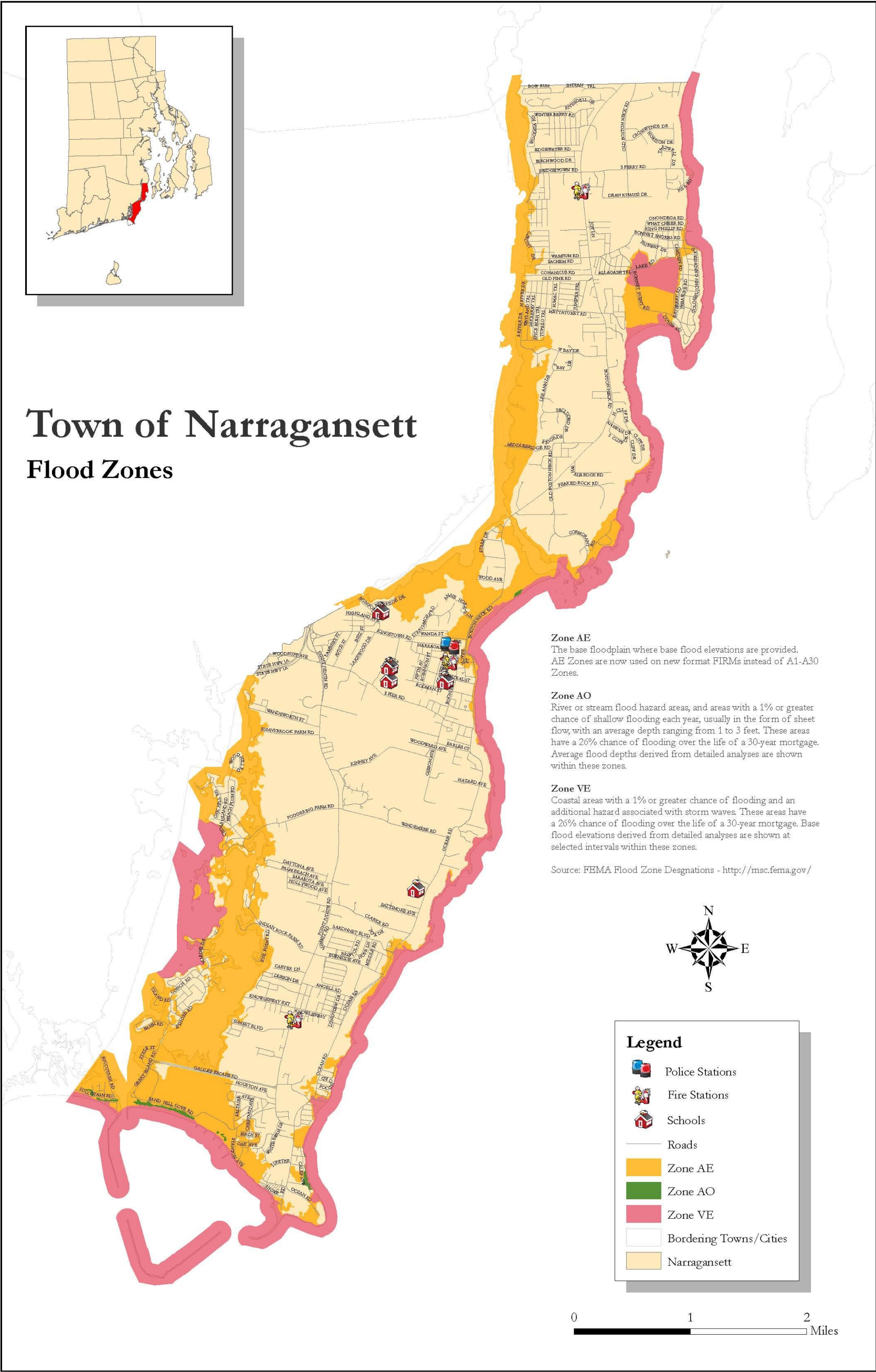
Map 2 - Sewer Infrastructure



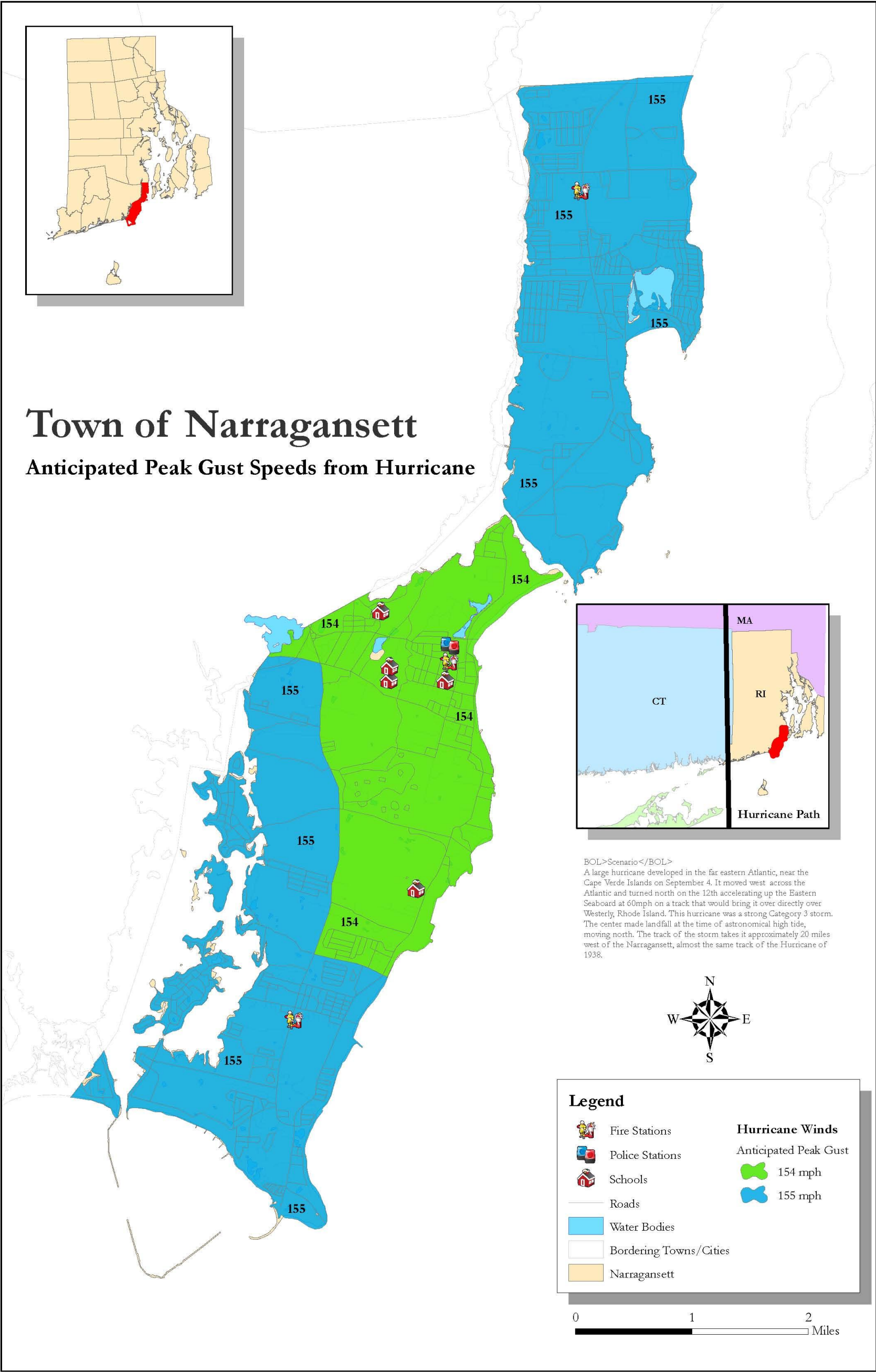
Map 3 – Water Supply



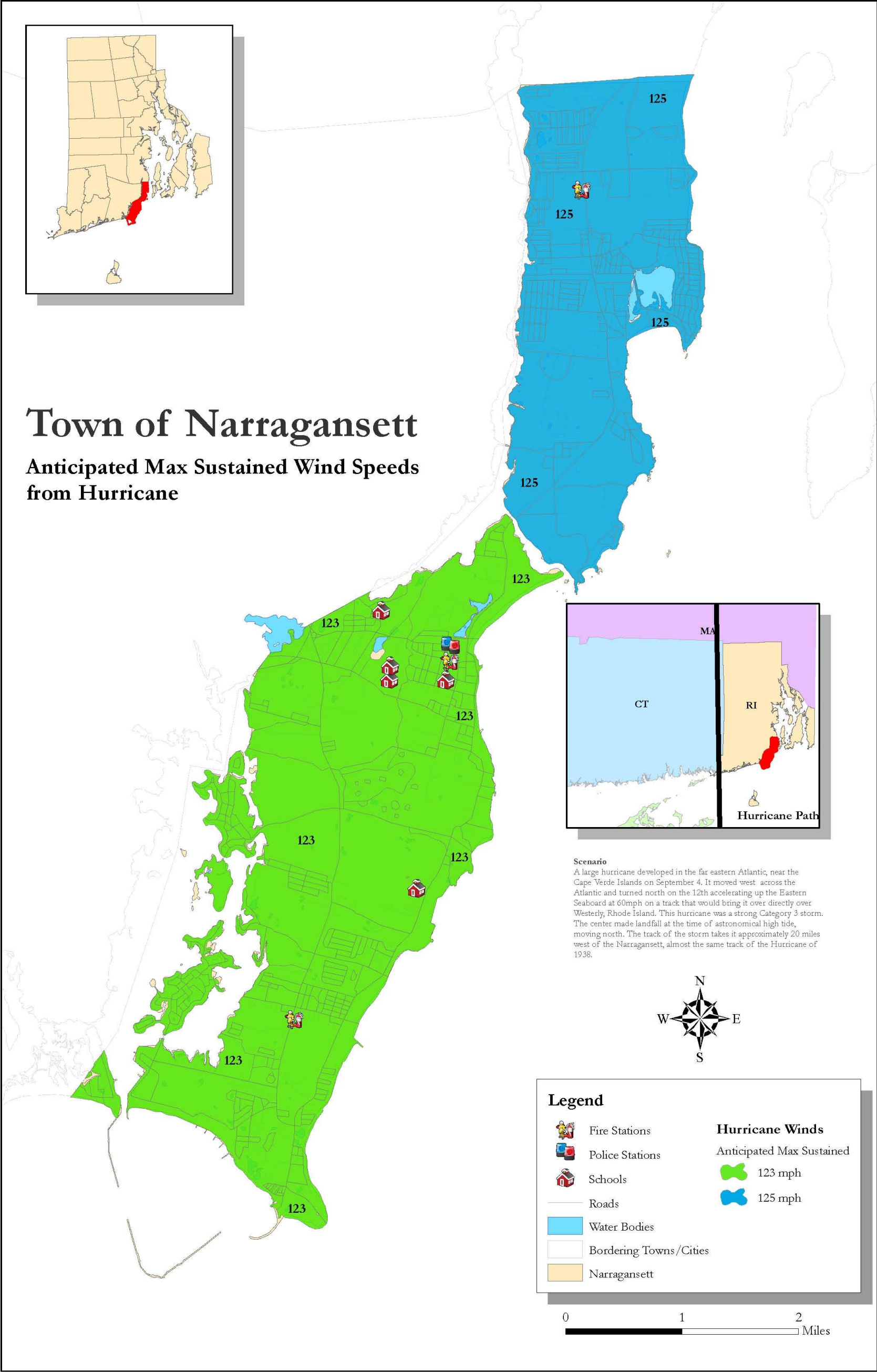
Map 4 – Flood Zones



Map 5 – Anticipated Peak Wind Speeds during Hurricane



Map 6 – Anticipated Max Sustained Wind Speeds from Hurricane



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- Neumann, C.J., et al. *Tropical Cyclones of the North Atlantic Ocean, 1871-1986*. Washington, D.C.: U.S. Department of Commerce. NOAA. 1987
- National Oceanic and Atmospheric Administration*. 2007. Web. <<http://noaa.com>>.
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- RI Water Resources Board. "Element 724: Rhode Island Drought Management Plan." June 2002.
- University of Washington. *Center for Science in the Earth System*. Climate Impacts Group: Joint Institute for the Study of the Atmosphere and Ocean. Web. <<http://cses.washington.edu/cig/>>.

Appendices

Appendix A: Technical and Financial Assistance for Mitigation

State Resources

Rhode Island Emergency Management Agency
645 New London Avenue
Cranston, RI 02920
(401) 946-9996

Coastal Resources Center
University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882
(401) 874-6224

Coastal Resources Management Council
Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879
(401) 222-2476

Department of Administration/Division of
Planning
One Capitol Hill
Providence, RI 02908
(401) 222-6478

State of Rhode Island Building Committee Office
Building Commissioner's Office
One Capitol Hill
Providence, RI 02903
(401) 222-3529

Rhode Island Builders Association
The Terry Lane Corporation
Terry Lane
Gloucester, RI 02814
(401) 568-8006

Department of Transportation-Design
Section/Bridges
2 Capitol Hill, Room 231D
Providence, RI 02903
(401) 222-2053

Rhode Island Department of Business
Regulations
233 Richmond Street Providence, RI 02903
(401) 222-2246

State Fire Marshal's Office
272 West Exchange Street
Providence, RI 02903
(401) 222-2335

Rhode Island Banking Commission/ Associate
Director
233 Richmond Street
Providence, RI 02903
(401) 222-2405

Public Utilities Commission
100 Orange Street
Providence, RI 02903
(401) 222-3500 Ext. 153

Department of Environmental Management
Division of Parks and Recreation
2321 Hartford Avenue
Johnston, RI 02919
(401) 222-2635

Federal Resources

Federal Emergency Management Agency
Mitigation Division
Region I Office
J.W. McCormack POCH, Room 462
Boston, MA 02109
(617) 223-9561

U.S. Army Corps of Engineers
New England District
424 Trapelo Road
Waltham, MA 02254
(617) 647-8505

U.S. Department of Agriculture
Natural Resources Conservation Service
(formerly Soil Conservation Service)
451 West Street
Amherst, MA 01002
(413) 253-4362

U.S. Department of Commerce
National Weather Service
Forecast Office
445 Myles Standish Boulevard
Taunton, MA 02780
(508) 823-2262

Economic Development Administration
143 North Main Street, Suite 209
Concord, NH 03301
(603) 225-1624

U.S. Department of the Interior
National Park Service
Rivers and Trails Conservation Program
Regional Office
15 State Street
Boston, MA 02109
(617) 223-5203

U.S. Fish and Wildlife Service
New England Field Office
22 Bridge Street, Unit #1
Concord, NH 03301-4986

U.S. Department of Housing and Urban
Development
Community Development Block Grants
Region I - O'Neill Federal Building
10 Causeway Street
Boston, MA 02222
(617) 565-5354

Small Business Administration
360 Rainbow Boulevard South, 3rd Floor
Niagara Falls, NY 14303
(716) 282-4612 or (800) 659-2955

U.S. Environmental Protection Agency
Region I - JFK Federal Building
Government Center
Boston, MA 02203
(617) 565 3400

Other Resources

The Association of State Floodplain Managers (ASFPM)

Professional association with a membership of almost 1,000 state employees that assists communities with the NFIP. ASFPM has developed a series of technical and topical research papers and a series of proceedings from their annual conferences. Many mitigation “success stories” have been documented through these resources and provide a good starting point for planning.

Floodplain Management Resources Center

Free library and referral service of the ASFPM for floodplain management publications. Co-located with the Natural Hazards Center at the University of Colorado in Boulder, staff can use keywords to identify useful publications from the more than 900 flood related documents in the library.

Institute for Business and Home Safety (IBHS)(formerly Insurance Institute for Property Loss Reduction)

An insurance industry-sponsored, nonprofit organization dedicated to reducing losses— deaths, injuries, and property damage—resulting from natural hazards. IBHS efforts are directed at five specific hazards: flood, windstorm, hail, earthquake, and wildfire. Through its public education efforts and information center, IBHS communicates the results of its research and statistical gathering, as well as mitigation information, to a broad audience.

Volunteer Organizations

Organizations, such as the American Red Cross, the Salvation Army, Habitat for Humanity, Interfaith, and the Mennonite Disaster Service, are often available to help after disasters. Service organizations, such as the Lions, Elks, and VFW are also available. These organizations have helped others with food, shelter, clothing, money, etc. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings incorporating mitigation or floodproofing concepts. The offices of individual organizations can be contacted directly, or the FEMA Regional Office may be able to assist.

Flood Relief Funds

After a disaster, local businesses, residents, and out-of-town groups often donate money to local relief funds. They may be managed by the local government, one or more local churches, or an ad hoc committee. No government disaster declaration is needed. Local officials should recommend that the funds be held until an applicant exhausts all sources of public disaster assistance. Doing so allows the funds to be used for mitigation and other projects that cannot be funded elsewhere.

New England States Emergency Consortium (NESEC) Lakeside Office Park

NESEC conducts public awareness and education programs on natural disaster and emergency management activities throughout New England. Brochures and videotapes are available on such topics as earthquake preparedness, mitigation, and hurricane safety tips. NESEC maintains a WWW home page that is accessible at <http://www.serve.com/NESEC>.

The New England Floodplain and Stormwater Managers Association (NEFSMA)

Professional organization for New England floodplain and stormwater managers. Provides workshops, conferences, and a newsletter to membership and interested individuals and companies. Contact: Nicholas Winter, chairman, at (617) 727-0488 or the NEFSMA home page on the Web at <http://www.seacoast.com/~nefsma>.

Appendix B: Existing Protection Systems - State and Federal

State

Earthquakes and Hurricanes

A certain amount of funding is allotted to each state per year based on a risk formula for earthquakes. Coastal states are allocated funds based on a risk formula for hurricanes. Each state receiving such funds has the ability to grant project funds to a community. There is not a match requirement on the part of the community, but the funds are limited, and are generally only available once a year. The projects or products proposed for such funding must demonstrate that earthquake or hurricane risk will be reduced or eliminated, and that the proposed project or product is a cost-effective measure (a stringent cost/benefit analysis need not be performed). Information about the amount of funding available per year and the state requirements for eligibility and performance may be obtained from RIEMA at (401) 946-9996.

Economic/Community Development

There may be programs existing to help flood-proof homes using Community Development Block Grant funds. There may be housing assistance programs in the community that can be used following a major flood, achieving both the objectives of reducing flood damage and improving the community's housing stock (see Appendix A, Federal Resources, for more information).

Evacuation Plans and Systems

Your community's emergency operations center should have evacuation plans in place. For communities near a nuclear power plant, evacuation plans are required, and may also be used for flood evacuation. RIEMA may have additional evacuation plan information.

Land Use Restrictions

There are several federal and state regulations that serve to restrict land use in certain areas that may help reduce flood hazard vulnerability. If your community has open land owned by the state or federal government, examine what restrictions are placed on its development. In addition, the state Wetlands Protection Act regulates the development of all lands identified as significant to the protection of resources identified in the act.

Septic Systems

If there are areas in the community not served by a public sewer system, state septic system regulations influence development and may be a consideration for mitigation alternatives that include rebuilding and elevation of structures. Specific design requirements must be met for any construction in coastal velocity zones or river floodways. Generally, an inspection of a septic system is required if there is a change in use of the structure, an increase in flow, or a failed system. Limited inspections are required if the footprint of the structure is being changed. Upgrades are required by the state if an inspection reveals a failed system. However, local regulations may be more restrictive than state requirements, requiring inspections or upgrades in other cases.

State Barrier Beaches

Your community may have barrier beaches, as defined by the state's Coastal Resources Management Program. The regulations applying to these areas are enforced by CRMC. These regulations restrict alteration of the beach and/or dunes and the construction of coastal engineering structures. New or substantially reconstructed buildings generally must be elevated to a minimum of 1 foot above base flood elevation. No new commercial development is allowed on barrier beaches. If a structure is damaged more than 50 percent, it cannot be rebuilt.

Warning Systems and Emergency Operations Plans

Your community may have a flood warning system in place and should have a plan for response to flooding. In addition, RIEMA has offices throughout the state that maintain area-wide plans for flood events.

Federal

Coastal Barrier Resource Act

Administered by the U.S. Fish and Wildlife Service, this program has mapped public and private land identified as undeveloped coastal barrier areas. These areas may be denoted as "Otherwise Protected Areas" if they are owned by public entities. In the coastal barrier areas shown on FEMA's flood insurance rate maps, structures newly built or substantially improved after the date shown on the maps are ineligible for federal flood insurance. This serves to restrict new development in these areas because the purchase of flood insurance is required to obtain federally backed mortgages and improvement loans for structures located in special flood hazard areas.

Community Rating System (CRS)

A voluntary initiative of the NFIP, the CRS was developed to encourage communities to perform activities that exceed the minimum NFIP floodplain management standards. If a community participating in the CRS performs activities that include maintaining records for floodplain development, publicizing the flood hazard, improving flood data, and conducting floodplain management planning, then the flood insurance premiums paid by policy holders in the community will be reduced by 5 to 45 percent. Developing a flood mitigation plan will help communities gain additional credit under the CRS.

Hazard Mitigation Grant Program

Also known as the 404 Program or HMGP, this program is available only after a federally declared disaster occurs. It represents an additional 15 percent of all the infrastructure and individual assistance funds that are provided to states to repair damages and recover from losses, and is administered by the state in partnership with FEMA. Having a plan or completed mitigation action matrix prior to a disaster event is extremely helpful in meeting the state's deadlines for applications and ensuring the project is eligible and technically feasible. It provides 75/25 matching grants on a competitive basis to state, local, and tribal governments, as well as to certain nonprofit organizations that can be matched by either cash or in-kind services. The grants are specifically directed toward reducing future hazard losses, and can be used for projects protecting property and resources against the damaging effects of floods, earthquakes, wind, and other hazards. Specific activities encouraged under the HMGP include acquiring damaged structures to turn the land over to the community for open space or recreational use, relocating damaged or damage-prone structures out of the hazard area, and retrofitting properties to resist the damaging effects of disasters. Retrofitting can include wet- or dry-flood-proofing, elevation of the structure above flood level, elevation of utilities, or proper anchoring of the structure. Two programs that have been authorized under the National Flood Insurance Reform Act of 1994 include the Flood Mitigation Assistance (FMA) program and a provision for increased cost of compliance (ICC) coverage. FMA makes grants available on a pre-disaster basis for flood mitigation planning and activities, including

acquisition, relocation, and retrofitting of structures. FMA grants for mitigation projects will be available only to those communities with approved hazard mitigation plans. ICC coverage has recently been implemented for all new NFIP policies and renewals and is intended to be “mitigation insurance” to allow homeowners whose structures have been repeatedly or substantially damaged to cover the cost of elevation and design requirements for rebuilding with their flood insurance claim up to a maximum of \$15,000. A certain amount of funding is allotted to each state per year based on a risk formula for floods. Each state has the discretion to award funds to communities or to state government agencies. States may use whatever criteria or method they choose to award the funds as long as the applicant and the proposal are eligible. The program may fund up to 75 percent of the total cost of the proposed project, with a minimum of 25 percent of the cost coming from the community. A minimum of half the community share must be cash or “hard match.” Funds can also be granted to communities to help them prepare local flood mitigation plans. The same match requirements apply. Once a community receives a planning grant, however, it is not eligible to receive additional planning grants for another five years. For further information on the FMA program or ICC coverage contact RIEMA at (401) 946-9996.

National Flood Insurance Program (NFIP)

All of Rhode Island’s 39 municipalities participate in the NFIP. This program is a direct agreement between the federal government and the local community that flood insurance will be made available to residents in exchange for community compliance with minimum floodplain management regulations. Communities participating in the NFIP must:

- Adopt the flood insurance rate maps as an overlay regulatory district
- Require that all new construction or substantial improvement to existing structures in the flood hazard area be elevated or (if nonresidential) flood-proofed to the identified flood level on the maps
- Require design techniques to minimize flood damage for structures being built in high hazard areas, such as floodways or velocity zones

In return for community adoption of these standards, any structure in that community is eligible for protection by flood insurance, which covers property owners from losses due to inundation from surface water of any source. Coverage for land subsidence, sewer backup, and water seepage is also available subject to the conditions outlined in the NFIP standard policy (see Appendix A, Federal Resources, for contacts regarding insurance coverage and purchase). Since homeowners insurance does not cover flooding, a community’s participation in the NFIP is vital to protecting property in the floodplain as well as being essential to ensure that federally backed mortgages and loans can be used to finance flood-prone property.

Appendix C: Public Information and Outreach



Town of Narragansett Hazard Mitigation Plan Public Meeting

The Town of Narragansett is currently conducting their five year update of the 2005 Hazard Mitigation Plan. The Town seeks public input on the plan development, a discussion of the hazards that affect the Town, and potential mitigation actions to address the vulnerabilities.

Please join us at a public meeting at the Narragansett Town Hall in the Town Council Chambers on October 12, 2011 at 3:00 P.M.

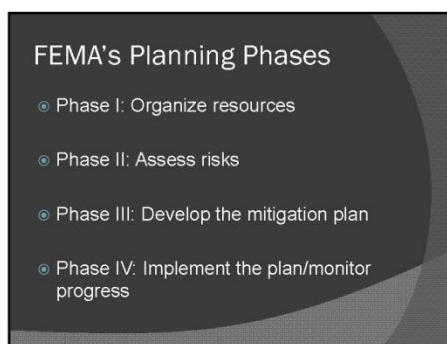
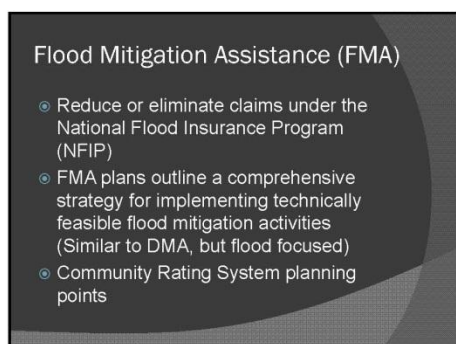
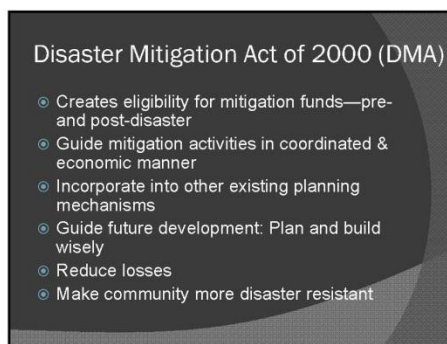
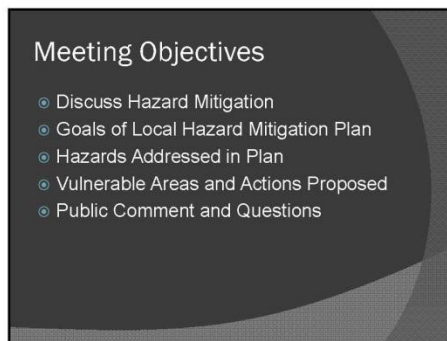
We look forward to your input in this process.



What: Hazard Mitigation Plan Update
Public Meeting

When: October 12, 2011 @ 3:00 PM

Where: Narragansett Town Hall,
Town Council Chambers



2011 Update – What's New?

- Hazards re-evaluated and plan reformatted
- More mapping
- New mitigation actions
- Review of current status of all mitigation actions in original plan

Goals

- Implementing hazard mitigation actions in order to protect Narragansett's cultural, historical, structural, economic, and natural environment.
 - Protect Narragansett's critical infrastructure.
 - Continue to manage the development in hazard-prone areas to reduce economic loss.
 - Continue to reduce flood losses through compliance with NFIP requirements.

Goals (cont.)

- Promoting educational opportunities to introduce residents and visitors to the risks of natural hazards and the various appropriate mitigation strategies that can be taken.
 - Continue and expand outreach efforts through the use of various communication methods.
 - Continue to work with residents on mitigation strategies.

Hazards



- Severe Storms
- Hurricanes
- Flooding and Dam Failure
- Earthquake
- Conflagration & Wildfire
- Tornadoes
- Heat Wave
- Drought

Hazards (cont.)

- Within the plan each hazard is profiled to include:
 - Hazard Problem
 - Past Occurrences
 - Timing and Duration
 - Magnitude
 - Frequency
 - Probability of Occurrence

Hazards (cont.)

- Also included:
 - What will be affected (where available data exists)
 - Estimated losses
 - Development trends
 - Critical facilities that could be affected

Mitigation Alternatives

- Alter
- Avert
- Adapt
- Avoid



Criteria for Selecting Mitigation Measures

- Will it work?
- Is it cost-beneficial?
- Is it affordable?
- Is it legal?
- Is it fair?
- Do people want it?
- Is funding available?
- Are there administrative burdens?
- Is it politically acceptable to community leaders?
- Is it environmentally sound?

Vulnerable Areas

- All-Hazards Mitigation of Property and Critical Roads
- Beach Erosion
- Ocean Road Seawall and Route 1A
- Sanitary Sewer/Water Lines and Mains
- Narragansett Beach and Pavilion, Bonnet Shores Beach and Pavilion

Vulnerable Areas (cont.)

- Great Island Bridge, Lacy Bridge, and Middlebridge Bridge
- Point Judith Pond Shoreline
- Tree Damage
- Galilee
- Sewage Treatment Facility
- Fisherman's Memorial Park
- Beachwood Apartments

Example Actions

- Create a Zoning Enforcement Program to ensure post-construction compliance on the originally approved construction design to ensure all dwelling units are up to code.
- Develop a policy that allows for the removal of pavement, concrete and other debris from the overwash. Remove overwash only in the immediate vicinity of houses, garages and other structures as necessary to provide reasonable and safe entrance and use.

Example Actions (cont.)

- Continue to enforce FEMA regulations for Point Judith Pond shoreline regarding rebuilding following substantial damage. All new structures will be elevated to FEMA regulations and retrofitted to withstand future damages.
- Establish plans for debris removal and disposal.
- Work with local utility companies to develop a program for regular tree trimming.

11/9/2011

Contact Information

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